

Title : Critical thinking: the impact of social influence

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# **Critical thinking: The impact of social influence**

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## Abstract

An under researched area of conformity and social influence is how it interferes with critical thinking. This study will investigate how critical thinking is interfered with by social influence in both Face to Face (FTF) and Computer Mediated Communication (CMC) within an academic discussion group. A systematic review was conducted to identify any existing literature on social influence and critical thinking in a blended learning environment, the results of the review found no relevant literature. Using a critical thinking task with different written language conditions, two experiments were conducted to investigate the effects of social influence on critical thinking and language on conformity. In study one participants were engaged in a critical thinking task in two consecutive discussion forums, either FTF-CMC or CMC-FTF, with a journal article that had been altered to be either formal or informal language. The results of this study found that there was no significant main effect between conditions but several significant interactions were found. Study two replicated study one, but with a slightly altered stimulus, to control for possible effects of obedience. The results of study two showed no significant main effects but significant interactions between conditions. The findings of the study show that the order of discussion forum can influence conforming behaviours and have an impact on critical thinking. The implications of the study are discussed.

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## Chapter 1

### 1.1 Introduction

One of the main responsibilities of educators within higher education is to develop and promote critical thinking amongst its students, granting them the ability to reflect upon material, concepts, and to question not only what they are being taught, but their own positions and perceptions as well. This could be seen as paramount for effective decision-making. Critical thinking is a vital component of decision-making, and is one of the primary learning objectives of an undergraduate degree (The Quality Assurance Agency for Higher Education, 2002). Although there are numerous definitions of what critical thinking is, it could generally refer to skills such as reasoning, questioning, analysing, judging, reflection and understanding (Mayer & Goodchild, 1990). Kuhn (1991), however, takes this further, labelling it as '*a reasoned argument with a social element*,' which refers to articulating and discussing ideas in collaboration with peers engaged in knowledge-building, and has been shown to promote higher learning. Learning has been shown to be more effective in both understanding and conceptualising knowledge when in a collaborative environment (Guillier, 2006), which better prepares the student for greater achievement in higher education, as well as in future employment.

Students are encouraged to use informal academic study and discussion groups, which are often integrated into academic modules, the purpose being that individuals collaborate and produce results through discussions (Price, Nir, & Cappella, 2006). The underpinning belief of business organisations proposes that group decisions will be better than individual ones, it is claimed that, although groups generally make better quality decisions, they still fail to be any better in quality than those of the best member of the group (Forsyth, 2013). With an emphasis in modern life on effective group decisions, whether they be informal, or within the work place, universities (in the majority of disciplines) incorporate group discussions and projects into their curriculums. So inevitably, within Higher Education (HE) and the working environment of peer interaction and working within groups, critical thinking becomes even more important. Research has evidenced that collaboration and group work can support deep learning (Baeten et al., 2010; Johnson et al., 2007), and enhance learners' engagement (Herrmann, 2013). Research has also reported that learners value opportunities for studying together, because collaborative activities can motivate, activate, and assist the development of their understanding of the content matters (Cavanagh, 2011).

Having participated in the development of various strategies to develop academic skills in both traditional face-to-face and online formats, and that most universities have implemented, in various guises, a form of Peer-Assisted Learning (PAL), with the aim of students who are further progressed in their studies to facilitate the learning of those recently arrived within the university environment (Rapley, 2014). Within these sessions, these students are encouraged to complete tasks, to consider concepts within groups, or to collaborate in their learning. Such group collaboration has been shown to develop critical thinking, deeper understanding of concepts, and higher learning. Generally, these are facilitated with a reasonable amount of guidance from the PAL facilitator. When the facilitators' presence is higher, the group's presence is lower, and critical thinking is greater, however, with minimal facilitators presence, the group's presence increases, and with it the level of social influence between groups (Costley, 2016). This is especially so, if others in the group are perceived as experts, more knowledgeable, or to hold greater authority (Rosander & Erikson, 2012), as it can lead to the Asch Effect, this is a cognitive bias where individuals agree to an obviously false conclusion, despite clearly seeing it as inaccurate (Mcleod, 2008). Furthermore, individuals feel strong emotional pressure to conform to those who are believed to hold particular expertise or majority positions (Webley, 2006).

So with increasing peer interaction and the social dynamics that follow, how does social influence in the form of conforming behaviours affect the individual's ability to critically think within the group? Conforming behaviours can be defined as the changing of thoughts, beliefs, attitudes, and behaviours to fit in with group norms (Aronson, Wilson & Akert, 2007). This occurs primarily from social influence where societal norms play a significant role in terms of conforming to the majority (Fiske, 2010). The influence of the majority can not only change an individual's judgments and behaviours, but can also influence how they think, often resulting in poor group decisions, and unfavourable outcomes on an individual (social groups) and institutional (education, workplace, governmental) level (Forsyth, 2013). Research has examined how social influence has affected decision-making in various environments, such as group dynamics, business, and political platforms. Utilising different paradigms, such as the hidden profile task, which looks at communication effectiveness when sharing information, and case studies that examine poor decision making at institutional and government levels. Research has focused primarily on various social dynamics in the assessment of effective decision-making, namely communication,



leadership style, and group cohesiveness, as well as investigating the underlying processes, such as majority influence, obedience, status, and expertise (Vroom, 2003).

With the continuing development of the Internet, and improved communication technology, online communication plays an important role in most people's lives nowadays. With both universities and employers incorporating various communication platforms into studies and work, human interpersonal interaction must come under the microscope, in regards to effective decision making. The development of blended learning approaches has shown benefits in various different designs of teaching. Studies have indicated that in collaborative learning, well-performing groups elaborate each other's responses, and ask complex questions, which signify high levels of cognitive processing (Näykki, 2014; Roscoe & Chi, 2008). This requires learners' commitment to joint activities and tasks, which can be manifested as equal and active participation in group work (Oliveira, 2011). Accomplishing a good collaborative group also requires time and effort from its members (Fransen, 2013). In addition, factors such as skills for reflecting one's own thoughts and strategies for coordinating the collaboration are needed in collaborative learning (Oliveira, 2011). To date, most research regarding critical thinking within blended learning environments has focused on the efficacy of the online platform when compared to traditional Face to Face (FTF) teaching, and comparisons between differing online environments and tasks set within them.

Computer Mediated Communication (CMC) provides a different platform for student discussion and interaction through asynchronous discussion groups, which allows students greater time to reflect on answers before responding, and should result in an increase of research-based evidence and higher levels of critical thinking (Guiller 2006). Asynchronous environments allow learners to use time for thinking, formulating their contributions and reacting to other learners' messages. However, the lack of real-time interaction can lead to one-way interaction (Wang and Woo, 2007) or 'broken threads' (Hewitt, 2005).

Asynchronous discussion forums are the most used discussion platforms used to generate learner-centered discussions in higher education settings (Johnson, 2007). The technology allows university students to ask questions, discuss issues, and observe how their peers are interacting with the content of any particular course. Their type of interaction is also important, with social interaction being shown to support learning (Kozan & Richardson, 2014).

Certain strategies that utilize CMC discussions forums within teaching have been linked to developing and promoting critical thinking skills. Using task orientated online discussions as an instructional method coupled with FTF teaching developed students critical thinking skills (Szabo & Schwartz, 2011) However, other research has found mixed findings in relation to the effectiveness of discussion platforms and the development of critical thinking (Gullier, 2006) . During online discussion levels of cognitive presence, the conceptualisation of ideas, connecting ideas, and applying ideas to other contexts rarely reach the highest potential (Lee, 2014). Although some research suggests that with group development online environments do indeed foster higher levels of cognitive presence (Guiller, 2006). Although one potential problem with asynchronous discussion platforms is that often the less engaged students, or those struggling with conceptual understanding of a problem, view participation as being more about generating content or posting statements than actual discussion (Wise, Speer, Marbouti, & Hsiao, 2013)

A goal within higher education is often described as engagement, which can be defined as the perception of enjoyment, interest and learning of is given subject and the motivation to complete an academic task (Jablon & Wilkinson, 2006). Activities that engage students have been shown to stimulate prior knowledge and allow experiential learning, encourage active investigation, increase peer interaction and develop independent learning (Jablon & Wilkinson, 2006). Findings from Comer and Lenaghan (2012) show that engagement is positively correlated to critical thinking, or the more engaged a student is the higher levels of critical thinking will be displayed. These findings suggest that discussion platforms, especially asynchronous, can be used to encourage critical thinking and peer interaction.

Comparing the two environments, Kamim (2001) found no differences between environments in terms of examination scores, although he did find that students participated more, and had less difficulty in relating to peers in the FTF environment. However, CMC produced significantly more thoughtful comments. Although levels of critical thinking have been found to be similar between FTF and CMC, it's been shown that FTF provides a greater volume of ideas, whereas CMC produces more important, justified, and well thought through arguments (Newman, Webb & Cochrane, 1995). Interaction in collaborative learning can be characterised by theoretical argumentation, negotiation, and questioning (King, 2007). The ability of e-learning, particularly asynchronous online forums, to develop both private reflection, and higher order discourse through collaborative learning, shows that e-learning has the characteristics to develop independent critical thinkers (Nui, BeharHorenson & Garven, 2013). Effective collaboration requires at least

some level of discourse, and the more in depth the discourse, the more in depth the collaboration. Recent research has shown that social presence is important because it can potentially improve levels of cognitive presence (Kozan & Richardson, 2014).

With the idea of social presence, and thus, social influence, researchers have begun to investigate the effects of conformity and social influence in online environments or computer-mediated-communication (CMC). Smilowitz, Compton and Flint (1998) replicated Asch's 1952 study, and found that the levels of conformity were lower online than compared to FTF environment, suggesting that majority influence was removed due to the lack of physical, or social presence of others. However, other research has shown that outside of the Asch paradigm (Asch effect), when group identity is already established, conformity is higher in both FTF and CMC than when no sense of group identity exists between the participants (Larporte, Nimwegen & Uyttendaele 2010). This suggest that social presence can be transferred to a CMC environment when a group identity has been established. In fact, Rosander and Eriksson (2012) demonstrated higher conformity online on knowledge and logic tasks, with conformity increasing when the task became harder and more ambiguous. Beran, Drefs, Kaba, Baz and Harbi (2015) found higher levels of conformity when there was a higher level of social presence in an educational fact test task, demonstrating that the higher the social presence of the group, the greater the chance of conforming behaviours. So with the importance of critical thinking in academic life and the increases in the use of blended learning within student courses, which leads to an increase of peer interaction and social presence, how can social influence interfere with critical thinking?

## 1.2 Literature review

### 1.3 Critical thinking skills

Developing critical thinking skills is an important goal of an undergraduate education with an undergraduate student being able to have the ability to make informed critical judgements and evaluate as part of their generic skill set (The Quality Assurance Agency for Higher Education, 2002). The ability to evaluate and critically think is a necessity for the student to have a complete and full understanding of theories, appreciation of evidence, topical core issues, and the conceptualisation of knowledge (Semerci, 2011). Most definitions of critical thinking relate to skillsets involving but not exclusive to: reasoning, questioning, evaluating, analysing, judging, inferring, conceptualising, understanding, and reflecting (Fahim & Hajimaghsood, 2014). An alternative to this definition is that of a type

of reasoned argument that contains a social element (Kuhn, 1991). Kuhn's (1991) alternate four-phase definition of critical thinking can be reduced to 1) differentiate an individual's view from the evidence, 2) support an individual's view with authentic evidence, 3) suggest alternate supporting evidence, and 4) provide evidence for one's view whilst refuting alternatives, using epistemological stance of evaluating the evidence. The social element refers to articulating and discussing ideas whilst in a collaborative process with a peer group. This social aspect of learning was emphasised by Vygotsky (1978) who emphasised the social dimension in knowledge and meaning construction facilitating conceptual development, and contributing to higher order learning, due to cognitive structuring or conflict resolution (Johnson & Johnson, 1999). When engaged in critical thinking, we evaluate how our thinking processes have reached solutions and conclusions. So, critical thinking must involve an element of reflective thinking that we focus on understanding issues, developing and evaluating solutions enabling us to make informed decisions. (Marzano, Pickering & Pollack, 2001).

A lot of factors influence critical thinking and decision making (Legant, 2010). Being a higher order process critical thinking is an automatic and subconscious process, it requires, effort, reflection, self-control or determination and metacognition (Mertes, 1991). Most researchers view critical thinking as involving ability and disposition with the main influencing factor that enhance critical thinking as motivation (Lai, 2011). According to Larson and Sung (2009), for critical thinking to be successful, an individual must not only have the ability to assess a situation critically but also have the disposition to do so. So, similar to metacognition, motivation is a condition for critical thinking, especially with difficult or challenging tasks where students are more motivated than simple tasks (Turner, 1999). Ideally, an individual will develop critical thinking skills at the same time as the disposition to be a critical thinker; this however isn't always the case (Facione & Facione, 2010).

The importance of acknowledging poor critical thinking dispositions cannot be over looked, because without intervention, poor thinking skills have been shown to lead individual and interpersonal self-deception (Facione & Facione, 2010). Factors of good critical thinking dispositions are amongst others: integrity, perseverance, courage, independence, and confidence in reason. Critical thinking without a good disposition can develop clever but manipulative, sub optimal decisions and often unethical or subjective thought (Papathanasiou, Kleisiaris, Fradelos, Kakou, & Kourkouta, 2014). Facione & Facione, (1997) investigated the relationship between critical-thinking skills and an individual's critical-

thinking dispositions. Individuals can have elements of both in abundance, whereas, some might have neither the disposition or the ability and others may have the ability without the disposition and vice versa.

## 1.4 Blended learning

Blended courses are the combination of aspects of online courses with aspects of traditional FTF classroom teaching (Donnelly, 2006, p.112). The aim of blending traditional FTF teaching with CMC is specifically to support student and student groups interpretation of content and use it as a source to develop deep learning and enhance discussion (Vaughn, 2014). Research has shown that an optimal environment can be developed using blended learning, leading to an enhancement of student engagement and success (Dziuban, Graham & Picciano, 2013), with the online element developing new opportunities to interact with peers, instructors and content (Allen, Seaman & Class, 2010). Blended courses have shown the potential to improve content, social interaction, reflection, higher order thinking, problem solving, collaborative learning (Norberg, Dziuban & Moskal, 2011). Social interaction is an important factor in establishing the level of an individual's learning, with the interaction process being considered to be of greater importance in learning than the outcomes. That being said only certain interactions lead to high level collaborative learning (Mercer and Howe, 2012). Collaborative learning is not promoted when presenting factual information and comments with argument (Oliveira et al., 2011). An essential aspect of successful collaboration is the social emotional aspect of interaction, which is where the group familiarise with each other to form a group (Volet et al., 2009), this process is an essential requirement for collaborative problem solving (Kreijns et al., 2003). However, research has shown that in genuine learning environments true collaboration and productive interaction is rare (Dillenbourg et al., 2009; Kreijns et al., 2003; Prestridge, 2014; Webb, 2009).

Cheng, Pare, Collimore & Joordens (2011) used 1000+ psychology students to demonstrate the value of peer interaction in terms of quality discussion online, with voluntary engagement in online discussions showing marginal improved academic outcomes on exams. Although the outcomes were only marginally better, this suggests there are benefits if students engage. Those that do not engage in blended learning miss out on quality peer interaction. Comparative research between FTF and CMC in student collaborative learning has shown that CMC was just as successful in terms of learning and

quality of problem solving, however, in terms of satisfaction with group interaction and discussion quality students were significantly less satisfied (Kamin, Glickin, Hall, Quarantillo & Merenstein, 2001). Furthermore, CMC groups generated more thoughtful comments and a greater degree of reflection, which is helpful in the development of critical thinking. A very early study (Newman, Webb & Cochrane, 1995) found depth of critical thinking to be similar in both FTF and CMC, with greater proportion of novel ideas generated in FTF, whereas ideas developed in CMC could be seen as of greater importance, justified and linked together conceptually. Jarvela and Hadwin (2013) claimed that for learners to interact and collaborate online, support should not only target critical thinking, but also develop learners' motivation, social development and emotional development

## 1.5 Online social influence

The effects of instruction on learner behaviour is an important component of understanding online learning (Heijltjes, van Gog, Leppink & Pass, 2015). Furthermore, studies have established the importance and effectiveness of instructor behaviour when students interact online (Andresen, 2009) and the effect of teaching presence on critical thinking in particular (Prasad, 2009). Smilowitz, Compton & Flint (1998) reported a decrease in conformity when compared to FTF research (17%), concluding that with no physical presence, the influence of the majority was moderated. This was found using a close adaptation of Asch's line paradigm in a CMC context. Taking this further, Cinnirella & Green (2007) also used the Asch paradigm to compare FTF and CMC groups with a control group, and found higher levels of conformity in both FTF and CMC, with CMC half the level of conformity compared to FTF group when compared to controls, they explained this by saying to increase conformity in CMC to group norms, the group presence needed to be salient and meaningful.

Larporte, Nimwegen & Uyttendaele (2010) utilised Asch's paradigm coupled with a fact test to look at levels of social presence, comparing conformity in different online environments, such as picture and video. This study found no conformity in the line task, but conformity was higher in a fact test condition for both environments; 15% and 28%, respectively.

Rosander & Eriksson (2012) comparing a control to an experimental group, utilised both factual and logic tasks in an online community. Presented inaccurate information via a series of multiple-choice questionnaires, participants in the experimental condition had graphs purporting to demonstrate the accuracy of inaccurate answers. They found participants conformed to the majority decision in the group and this being due to the

group having a salient identity and strong presence. Beran, Drefs, Kaba, Baz & Harbi (2015) conducted one of the only studies to date that has examined student conformity in a CMC environment, utilising education studies students in a synchronous environment with audio and visual capacity, where students could interact with instructors and peers. Students were randomly assigned between experimental and control conditions, and were given 10 multiple-choice, curriculum-based questions. In the experimental conditions, participants could see the incorrect answers given by their peers (confederates). There was a significant difference between groups, with the experimental group being more likely to conform to incorrect answers than the control group that did not see any answers.

Few studies have investigated conformity and decision-making in academic environments and there appears to be no literature on how conformity interferes with critical thinking in blended-learning environments. Thus, this study aims to investigate how social influence interferes with critical thinking in a blended-learning environment and to examine how each environment moderates critical thinking. Due to the apparent lack of literature in this area a systematic review will be conducted to assess whether social influence has been investigated in conjunction with critical thinking.

## Chapter 2 Systematic review

### **Does social influence interfere with critical thinking?**

#### 2.1 Abstract

**Objective:** To examine how social influence interferes with critical thinking in a blended learning environment and to what extent student engagement and the promotion of critical thinking skills can moderate against social influence.

**Methods:** A systematic review was undertaken. A single search solution database (Discover) was searched using the following search terms: critical thinking skills, blended learning, group based activities, students and pedagogy. The resulting citation list was examined to identify relevant journal articles. Following this the relevant data was extracted and a narrative synthesis was conducted of the evidence provided on the interference of critical thinking by social influence, student engagement and the promotion of critical thinking skills.

**Results:** Nine relevant studies were identified: Four examined critical thinking in blended-learning environments, three addressed student engagement and one addressed social presence, the final study examined instructor influence and critical thinking in blended-learning.

**Conclusion:** Some formats of blended-learning promote critical thinking skills. The level of instruction appears to have an impact on both critical thinking and social presence and in turn social presence moderates critical thinking levels. Although students may have critical thinking ability they may not be motivated to use it or they may not have the skills to apply it in academic environments. Different elements of critical thinking are prevalent in different environments, with higher levels of reflection and conceptual understanding shown in CMC.

#### 2.2 Introduction

One of the main responsibilities of educators within higher education is to develop and promote critical thinking amongst its students, granting them the ability to reflect upon material, concepts, and to question, not only what they are being taught, but their own positions and perceptions as well. This could be seen as paramount for effective decision-making. Critical thinking is a vital component of decision-making, and is one of the learning



objectives of an undergraduate degree (The Quality Assurance Agency for Higher Education, 2002). Although there are numerous definitions of what critical thinking is, it could generally refer to skills such as reasoning, questioning, reflecting, analysing, judging, and understanding (Mayer & Goodchild, 1990). Kuhn (1991), however, takes this further, including a social element to argumentation, which refers to articulating and discussing ideas in collaboration with peers engaged in knowledge-building, and has been shown to promote higher learning. With an emphasis in modern life on effective group decisions, whether they be informal, or within the work place, universities (in the majority of disciplines) incorporate group discussions and projects into their curriculums. So inevitably, within Higher Education (HE) and the working environment of peer interaction and working within groups, critical thinking becomes even more important. Research has evidenced that collaboration and group work can support deep learning (Baeten et al., 2010; Johnson et al., 2007), and enhance learners' engagement (Herrmann, 2013).

Research has also reported that learners value opportunities for studying together, because collaborative activities can motivate, activate, and assist the development of their understanding of the content matters (Cavanagh, 2011). The development of blended learning approaches has shown benefits in various different designs of teaching. Studies have indicated that in collaborative learning, well-performing groups elaborate each other's responses, and ask complex questions, which signify high levels of cognitive processing (Näykki et al., 2014; Roscoe and Chi, 2008). This requires learners' commitment to joint activities and tasks, which can manifest as equal and active participation in group work (Oliveir, 2011). Accomplishing a good collaborative group also requires time and effort from its members (Fransen et al., 2013). In addition, factors such as skills for reflecting one's own thoughts and strategies for coordinating the collaboration are needed in collaborative learning (Oliveira, 2011).

A goal within higher education is often described as engagement, which can be defined as the perception of enjoyment, interest and learning of a given subject and the motivation to complete an academic task (Jablon & Wilkinson, 2006). Activities that engage students have been shown to stimulate prior knowledge and allow experiential learning, encourage active investigation, increase peer interaction and develop independent learning (Jablon & Wilkinson, 2006). Findings from Comer and Lenaghan (2012) show that engagement is positively correlated to critical thinking, or the more engaged a student is the higher levels of critical thinking will be displayed. These findings suggest that discussion platforms, especially asynchronous, can be used to encourage critical thinking and peer interaction.

Although, as previously mentioned, some participants merely post comments for the sake of generating content. This implies a lack of attention, engagement and attention to other participants' ideas (Wise et al, 2013).

The result of this is conformity, and thus, researchers have begun to investigate the effects of conformity and social influence in online environments or computer-mediated-communication (CMC). Smilowitz, Compton and Flint (1998) replicated Asch's 1952 study, and found that the levels of conformity were lower online than compared to FTF environment, suggesting that majority influence was removed due to the lack of physical, or social presence of others. However, other research has shown that outside of the Asch paradigm (Asch effect), when group identity is already established, conformity is higher in both FTF and CMC than when no sense of group identity exists between the participants. This suggests that social presence can be transferred to a CMC environment. In fact, Rosander and Eriksson (2012) demonstrated higher conformity online on knowledge and logic tasks, with conformity increasing when the task became harder and more ambiguous. This is similar to FTF when research has moved away from simple stimuli (Asch, 1952, Crutchfield, 1966. As online interaction is usually text-based, computer-mediated communication (text messaging, discussion forums, and email), it is very different from face-to-face (FTF) interaction as non-verbal aspects of communication (e.g. body language) are removed in CMC (Cinnirella & Green, 2007).

Peer-Assisted Learning (PAL) is a scheme that is now being implemented in most universities, its aim is to facilitate the learning and adjustment of students who are new to the university environment (Rapley, 2014). This facilitation is most commonly carried out by students in later years of their courses, sometimes aided and guided by academic staff for structure and content. Most PAL schemes operate to encourage learning within a group setting; this includes the completion of tasks, as well as discussions and collaboration within the group. Guiller et al. (2006) found that such group collaboration promotes the further development of critical thinking skills, abets a deeper understanding of concepts, and eventually enables higher learning.

This, however, is dependent on certain conditions; according to deNoylles (2011), when the presence of the facilitator is high (thus group presence is low), critical thinking is further encouraged, whereas when the facilitator has a minimal presence, social influences within the group play a larger role in ultimate decision-making. This is especially so, if individuals in the group are perceived as experts, to be more knowledgeable, or to hold greater

authority within the group (Rosander & Erikson, 2012). This social influence may lead to the Asch Effect; a cognitive bias where individuals may agree to a blatantly false answer or conclusion, due to the impact of said social influences (McLeod, 2008). A similar measure of conformity is seen amongst individuals who feel a strong need to acquiesce to authority figures, including individuals who are perceived as holding more expertise or credibility (Webley, 2006).

Although conformity has been investigated in both FTF and CMC, none have investigated the impact of these two environments combined. Thus, the aim of this study is to examine the effect of written language and conformity on critical thinking in both FTF and CMC environments, and whether engagement has a moderating influence in the different environments. This study aims to simulate the different ways in which critical thinking may be interfered with in a blended-learning environment.

## 2.3 Methods

This review is restricted to articles published in peer-reviewed journals listed on the single solution database (Discover) up until September 2016.

### **Search Strategy**

A literature search was conducted to identify relevant research for a wider review including relevant adjacent fields of research. The search included student engagement and developing critical thinking skills using a single solution database (Discover) with free text terms. A number of search terms were combined: critical thinking skills, blended learning, group based activities, students and pedagogy. The literature search was limited to English language articles and there were not any restrictions on date. Search was conducted in September 2016. The reference lists of relevant studies were searched for further relevant studies.

Full text articles were retrieved for titles and abstracts that satisfied the inclusion criteria or if exclusion or inclusion could not be explicitly determined. The same inclusion and exclusion criteria applied for assessment of full text articles. Only empirical studies were included, reviews and position papers were excluded.

### **Inclusion and exclusion criteria**

Citations produced by the search were identified as relevant by one reviewer. The studies were eligible for inclusion if they contained a combination of critical thinking and two or

more of the following constructs: critical thinking, blended learning, group based activities, students, peer interaction or pedagogy within the required population (Higher education). Any studies that did not have a combination of the constructs or covered primary or secondary education were excluded. Full text articles were retrieved for titles and abstracts that satisfied the inclusion criteria or if exclusion or inclusion could not be explicitly determined. The same inclusion and exclusion criteria applied for assessment of full text articles. Peer-reviewed journals were selected as a minimum criterion for quality control of the studies selected

### **Data extraction**

Data from all articles included were extracted by one reviewer, data included: Source, type of study, construct investigated, theoretical model (if any), analysis and design, participants and findings. The wider review search on critical thinking, blended learning, group based activities, peer interaction, students and pedagogy produced 837 unique citations. Of these, 815 were excluded at the title and abstract stage due to focusing on a topic other than critical thinking or being reviews, with 22 being examined in full text; 13 of which was excluded for being position papers or reviews of individual areas, 9 articles met the criteria for inclusion in this review.

## **2.4 Results**

### **Study characteristics**

The majority of the studies were conducted outside of Europe, two in the USA, one in Canada, one in Korea and one in Taiwan. The European studies were conducted in the UK (two), Turkey and one study across three countries (Finland, Romania and Estonia). The sample sizes across the studies ranged from 31 to 900 with the total sample 2098. The proportion of male to females was rarely reported, neither was ethnicity. One study specifically reported on social influence (in the form of social presence) (Costley, 2016). Social influence was not the specific object of study in the remainder of the articles.

### **Measures**

The range of measures varied between the studies, there were no disqualifying criteria as far as measurement of constructs were concerned. There was one mixed method study, (deNoyelles & Reyes-Foster, 2015) which used T-tests to assess the difference between language presentation and thematic analysis for critical thinking and engagement, this over a 12 month period. Four studies employed quantitative measurements to varying

constructs: Guiller, Durndell and Ross, (2006) used content analysis to compare critical thinking statements and interactions between FTF and CMC. Larson and Sung, (2009) used Analysis of Variance to establish difference between exam and final grades between FTF and CMC. Using a pre and post-test questionnaire Yu, Lin, Ho and Wang (2015) looked at FTF, problem-based learning and blended problem based learning to assess critical thinking dispositions. An Analysis of Variance was used by Costley, (2016) to investigate the effect of social presence on critical thinking. Four studies used qualitative measures: Vuopala, Hyvonen and Jarvela (2015) used a qualitative method of content analysis to assess collaboration within different learning environments. Vaughn (2010) used thematic analysis to identify differences in student engagement and design of course. Looking at critical thinking and argumentation Joiner and Jones (2003) used content analysis. Finally Wang, (2005) who investigated how questioning skills facilitate discussion, used content analysis.

### **Constructs**

Four studies looked at peer interaction in combination with other inclusion criteria: Collaborative learning (Vuopola, Hyvoron & Jarvela, 2016), knowledge construction (Wang, 2011), critical thinking (Guiller, Durnell & Ross, 2008). Three studies looked at engagement and motivation in combination: Critical thinking (Yu, Lin, Ho, Wang, 2015), blended learning (Vaughn 2016), critical thinking (Larson & sung, 2009). Four studies looked at critical thinking in combination: Social presence (Costley, 2016), presentation of language (deNoyelles & Foster 2015), blended learning (Joiner & Jones, 2003), questioning skills and collaborative learning (Wang, 2005).

### **Peer Interaction**

Four papers investigated peer interaction in combination with other inclusion criteria. Vuopola, Hyvoron and Jarvela, (2016) examined collaborative learning to explore and understand how student interaction makes for successful collaborative learning. Investigated during a university course which was mediated by two different types of virtual learning environment, results indicate that interaction in collaborative situations was more often group-related than task-related. Group related interaction concentrated mostly on coordination of group work, such as planning and organising group activities. With the differences of interactions within different environments this can help inform educators on the organisation and enhancement of collaborative learning in both FTF and CMC. Guiller, Durnell and Ross, (2006) investigated critical thinking: with 55 students they used a comparative study to investigate FTF and CMC for evidence of critical thinking. Used

content analysis to compare scripts from each mode and a questionnaire to established preferred mode of discussion. They found more evidence of critical thinking statements in the online environment with students preferring this mode of discussion.

### **Blended Learning**

Four papers looked at blended learning: Wang, (2005) concluded that developing questioning skills increased the students ability to strengthen argumentation, which, facilitated understanding, aided investigation and promoted the conceptualisation of how assumptions, perspectives and biases impact on the way knowledge is constructed within a discipline. The usage of open ended questioning allowed students to develop multiple perspectives and increased task participation. Higher level questioning, such as probing, synthesis and comparisons required students to utilise higher order thinking processes due to the complex thinking that's needed to construct understanding. Joiner and Jones, (2003), used different communication mediums to investigate the quality of argumentation and the environment that promoted critical thinking skills, they compared CMC over a 2-week period and FTF over a 1-hour seminar they found no improvement between pre-test and post-test. However, argumentation was of a higher quality in FTF condition, with higher level questioning promoting argumentation. Costley, (2016) examined three important elements learning in an online environment; teaching presence, social presence and cognitive presence and the importance of how the three interact. The research demonstrated that when there were higher levels of teacher/instructor presence within the learning environment, student social presence dropped but cognitive presence increased. Conversely, with lower levels of instructor presence the students social presence increased but to the detriment of cognitive presence. This shows that it's a fine balance of instructor control to allow not only social presence of the students to flourish but their cognitive presence too, which will allow for greater and freer discussions with higher levels of critical thinking.

### **Engagement**

Three papers looked at engagement: Vaughn (2010) showed how introducing differing collaborative learning techniques to a blended approach to teaching can be used to develop and scaffold assessment activities that promote higher levels of student engagement not only with course concepts, but student interaction and interaction with

faculty and external experts. She found that the design of blended learning is important for engagement and development of experiences within the collaborative learning environment enabling students to independently learn and further conceptual understanding through discussion. Yu, Lin, Ho and Wang (2015) examined the impact of the disposition or will of the individual to critically think in relation to enabling successful academic outcomes. Their findings demonstrated that using problem based (PBL) learning techniques that there was increased likelihood of successful academic outcomes, with students being able to conceptualise and understand topical content to a greater degree. There were no significance differences between the groups in critical thinking disposition. deNoyelles and Foster (2015), investigated the how the inclusion of word clouds, which are word frequency counts visually represented, into online learning environments affected critical thinking, peer interaction and student engagement. By examining the word cloud text in discussion groups it was found that critical thinking and engagement of students was moderately increased when compared to a linear text presentation. Furthermore, they found a positive relationship between critical thinking and engagement, and peer interaction. Although not a traditional representation of text it was demonstrated that the way content is presented has an impact on thinking, engagement and interaction.

**Table 1: summary of studies**

| Source                              | Type of study | Purpose  | Theoretical model                     | Analysis/design  | Participants  | Findings  |
|-------------------------------------|---------------|--|---------------------------------------|--|---|---|
| Vuopala, Hyvonen and Jarvela (2016) | Qualitative   | Examine how participants interact in collaborative learning using online environments<br><br>Keywords: collaborative learning, computer-supported collaborative learning, higher education, social interaction, virtual learning environment | social constructivist learning theory | Case study – content analysis/group task to design learning tool<br><br>2 vls – synchronous and asynchronous | 54 higher education students from 3 European universities | interaction in collaborative situations was more often group-related than task-related. Group-related interaction concentrated mostly on coordination of group work, such as planning and organising group activities. Task-related interaction was mostly in the form of comments or answers to earlier messages |
| Wang (2005)                         | Qualitative   | Examine how students interact and how they construct knowledge in an online environment using high level question techniques.<br><br>Keywords e-learning, online synchronous discussion, questioning skills                                  | social constructivist                 | Thematic analysis/content analysis   |   | Findings show that higher level questioning develops argument position which aids construction of knowledge   |
| Yu, Lin, Ho and Wang (2015)         | Quantitative  | Student engagement and willingness to  |                                       | quasi-experimental<br><br>3 learning environments/   | 150 undergraduate nursing                                 | blended problem based learning  |



| Source                     | Type of study | Purpose  | Theoretical model    | Analysis/design   | Participants     | Findings  |
|----------------------------|---------------|--|----------------------|---|------------------|---|
|                            |               | think critically   |                      | The California Critical Thinking Disposition Inventory/pretest-posttest/ MANOVA / ANOVA /ANCOVA |                  | enhanced academic achievement   |
| Costley (2016)             | Quantitative  | How instructional design and presence impacts on student social and cognitive presence in online environment.        | Community of Inquiry | three experimental conditions<br><br>ANOVA  | 219 participants | Higher levels of instructor presence decreases student social presence but increase student cognitive presence              |
| deNoyelles & Foster (2015) | mixed-methods | The impact of introducing word clouds in online discussions on critical thinking, student interaction and engagement |                      | quasi-experimental<br><br>thematic and t test   |                  | That there positive increase between critical thinking, interaction and engagement dependant on format of text presentation |
| Joiner and Jones (2003)    | Qualitative   | Effects of communication medium on argumentation and critical thinking   |                      | Content analysis  | 73 undergrad     | No significance between conditions on argumentation, however the quality in cmc was higher                                  |
| Vaughn (2010)              | Qualitative   | Student engagement and design of course  |                      | Thematic analysis   | 241              |   |
| Guiller, Durndell          | Quantitative  | Peer interaction and critical  |                      | Content analysis  | 55               | Greater critical thinking in  |

| Source                 | Type of study | Purpose   | Theoretical model | Analysis/design | Participants | Findings  |
|------------------------|---------------|---|-------------------|-----------------|--------------|---|
| and Ross (2006)        |               | thinking in blended learning                      |                   |                 |              | online and students preferred                                   |
| Larson and Sung (2009) | Quantative    | Student performance enagement in blended learning |                   | ANOVA           |              | No differences in academic outcomes, higher satisfaction online |

## 2.5 Discussion

Four studies looked at peer interaction, four looked at blended learning whilst three looked at motivation. All of these papers were in combination with either critical thinking, collaborative learning or format of communication medium. Only one paper looked at a form of social influence in the form of social presence. In regards to online discussion the findings of the study showed that by withdrawing the presence of the instructor, the presence of the group became greater. Worryingly, with higher group presence the levels of critical thinking dropped, demonstrating that there needs to be a balance between instructor presence, to ensure critical thinking, but allowing enough of a group presence to stimulate a free flowing discussion (Costley, 2016). Interestingly there seems to be little evidence on balance of a more effective forum for critical thinking (Larson & Sung, 2009: Joiner & Jones, 2003). However, these same studies cite that higher quality outcomes are achieved in CMC in terms of increased student satisfaction (Larson & Sung, 2009) and a higher quality and level of argumentation (Joiner & Jones, 2003). It must be noted however that the measurements and type of learning platform differ between the papers, sometimes subtly, sometimes greatly. With Larson et al's (2009) paper using analysis of variance with academic outcomes and questionnaires, Joiner et al (2003) using qualitative content analysis, both of the papers presented do advocate a combination of the two.

With regards to critical thinking and the learning environments, the evidence points to different levels and/or types of thinking, with FTF generating better engagement of discussions and a greater level of argumentation (elements of critical thinking) CMC provides a greater level of thoughtfulness, reflection and inter connected ideas (Guiller et

al, 2006). With participants demonstrating marginally better academic outcomes within the CMC environment, suggesting that voluntary participation in CMC can have an enhancing effect on students (Yo, et al, 2016). How the CMC environment is presented had a greater impact on discussion (Vuopala et al 2016), with differing questions eliciting greater levels of discussion and argumentation and developing higher order thinking (Wang, 2005). Also how text is presented has a significant impact into critical thinking, with linear text showing significantly lower levels of critical thinking, reflection and idea generation than if produced in a pictorial format (deNoyelles et al 2015).

With regards to the collaboration aspect, collaborative situations were more often group-related than task-related. In CMC groups tended to focus more on organisation of the group and task allocation than actual task concepts (Vuopala et al, 2016), although, from a collaborative viewpoint, students preferred the CMC format of discussions to the traditional FTF groups (Wang, 2005: Guillier et al, 2006: Larson et al, 2009). There was no evidence of significantly different knowledge construction between the groups, suggesting that the discussions were on par with each other (Wang, 2005). As with other aspects of this study (critical thinking in learning environments) the concepts measured were again different and analysed in different ways.

Students appear more motivated and engaged within the CMC environment as compared to FTF, showing increased engagement with peers, staff and external experts. Student motivation to actually critically think has been demonstrated to involve not only the ability or process of thinking, but the actual disposition to use the ability is just as important. With the research highlighting that some participants either have low motivation to critically think or haven't developed the dispositional skill to use critical thinking skills in an academic environment which results in either poor outcomes or ill-judged positions.

### **Strengths and limitations**

This review is the first to have investigated interference with critical thinking from social influence and to give a narrative synthesis of the findings. The review does have some limitations. Whilst the literature search was reasonably comprehensive, it was limited to single solution database (Discover, which encompasses unknown databases) and reference list checking of included studies and the study selection process was limited to one reviewer. Although, only peer reviewed empirical research was selected for inclusion in the review.

However, the mixed methodologies and variability does serve to give an interesting and balanced inter related view of the subject area with the measurements and analysis being heterogeneous. The measurements used within individual studies were all different as were the constructs measured. Guiller et al. (2006) compared critical thinking and levels of peer interaction using a validated scale, however, it can be argued that the differences found within the learning environments are simply different elements of critical thinking. Very few of the studies used a generalisable sample, choosing instead to use participants from a specific discipline and as such there is a strong argument that different students from different disciplines will inevitably have different levels of critical thinking, mainly due to the demands of their course.

## **Conclusion**

Overall, it is difficult to separate the concepts and deal with them in isolation. Critical thinking within learning environments is all inter-related, firstly with will or motivation to use the skill set and the levels students operate at within various environments is affected not only by the environment but how that environment is set up. Overall it can be seen from the above literature that student engagement and motivation is higher within a CMC environment if it is correctly set up and blended effectively with traditional FTF learning. The only study that looked at a form of social influence interestingly shows that in both FTF and CMC the greater impact the instructor has on the discussion process, either directly or indirectly, the higher levels of critical thinking; when the groups presence outweighs the instructors and their social dynamic takes over there is a higher incidence of less critical thinking and poorer outcomes. So in conclusion a number of pre conditions must be in place for critical thinking to take place in learning environments in the first place and other than social presence there are no papers that have investigated the effects of social influence on critical thinking, although it must be repeated that engagement with peers and content and the environment students participate in all play a part in thinking critically.

## Chapter 3 Study 1

### 3.1 Introduction

As online interaction within blended-learning is usually text-based, it is very different from FTF interaction as non-verbal aspects of communication (e.g. body language) are removed in CMC (Cinnirella & Green, 2007). To communicate ideas and engage in a collaborative discussion the importance of written language cannot be underestimated when communicating in online environments. In relation to how written language is perceived, Scott, Sinclair, Short & Bruce (2014) found that poor spelling and grammatical errors were viewed as less intelligent than either articulate, or text-message based text, and concluded that it is not what you say, but how you say it. Ward (2014) investigated conformity and the effect of language in both FTF and CMC environments, finding that participants conformed to a higher degree when presented with clear articulate language when compared to informal text messaging language.

As intelligence is a factor considered when we consider expertise, it could be safe to reason that clear, articulately written academic language is more likely to be paid attention to and considered expert. Taken with the findings from the systematic review, the purpose of this study is to investigate a so far un-researched area in how social influence can interfere with critical thinking in blended learning environments. The study will use a critical thinking task with two experimental conditions of discussion forum order FTF-CMC and CMC-FTF and two experimental conditions of language readability levels, high readability and low readability. The high readability will be articulate and grammatically correct with the reasonable assumption that it will be considered expert, whereas the low readability condition will be poorly structured grammatically and have a lower level of articulation.

H1 Social influence will interfere with critical thinking

H2 There will be higher levels of conformity in FTF when compared to CMC

H3 The level of conformity will be higher in the high readability conditions.

## 3.2 Method

### Participants

Forty-eight undergraduate and postgraduate students from the University of Bedfordshire participated in this study (School of Psychology, Business School, Education Studies, Computing, Health and Social Studies, Applied Social Studies). They were recruited via flyers placed around the university that invited them to participate in a research project and to email the researcher. The sample consisted of 34 (70.8%) females/14 (29.2%) males, aged 19 -36 mean 23.43(4.78), all participants were students eligible for student finance. Students that were sponsored or paying for the cost of their education were excluded from the study due to the reasonable assumption that they less likely to have paid close attention to the changes made in student funding.

### Design

The study was a 2 (Readability; High vs Low) x 2 (Forum order; Face to Face (FTF) – Online (CMC) vs CMC - FTF) x 4 (Factual Manipulation: Date, Cash value, Time, Name) mixed factorial design. Readability is graduate level (high) versus start of high school (low). Readability and forum order variables comprise the between subjects elements of the study and the factual manipulations comprised the within subject element, thus all participants will complete all manipulations within this variable. Participants were randomly allocated into groups of four to one of four conditions, resulting in twelve groups. The dependant variables (DV) are four questions, assessing consensus to group opinion, decision confidence, conforming for membership, and pressure to conform, measured on a 7 point Likert scale. 1 = strongly disagree and 7 = strongly agree.

### Stimuli and apparatus

Three excerpts were taken from Chowdry, et al., (2012). The Distributional Impact of the 2012–13, Higher Education Funding Reforms in England, *Fiscal Studies*, 33, 2, 211–236. (Appendix 1). The excerpts cover the basics of discussions surrounding the highly publicised rise in student fees, including the background, costs, repayments, and agencies involved. These excerpts were chosen due to the belief that even the most unengaged student would have been exposed to at least some of the facts and figures surrounding a highly contentious issue.

The rationale to develop two different readability levels of stimuli follows that in both a FTF and CMC environments a critical evaluation of an academic article would see the stimuli presented in text and following on from Ward's, (2014) finding that significant differences

existed between text types, this task further investigates and expands upon differences in text presentation.

To develop the high readability stimuli, the three excerpts were combined into an article with the original article title included. To assess readability, the Gunning Fog Index (GFI) (Gunning Fog Readability Index, 2014) (Appendix 2) was used, which is, an online linguistic tool measuring the readability of written English. The index estimates the years of formal education needed to understand the text on a first reading. A fog index of 12 requires the reading level of an 18 years old. The entire text was copied into the Gunning Fog Readability Index (<http://gunning-fog-index.com>), which is an online tool that calculates the GFI. It is a weighted average of the number of words per sentence, and the number of long words per sentence. One interpretation is that the text can be understood by someone who left full-time education at a later age than the index score. The paper used as high readability stimuli had an index score of 15.87, and consisted of 583 words (authors and title not included), 23 major punctuation marks, and 84 words of three or more syllables.

The low readability stimuli used the same paper as high readability stimuli, but had sentence length adjusted (less words per sentence), and words with three syllables or more, were reduced to a two syllable word where possible, using synonyms from an online dictionary. <http://www.oxforddictionaries.com>. This stimulus had a GFI score of 8.23 and consisted of 559 words, 32 major punctuation marks, and 20 words of three or more syllables (Appendix 3). The low readability stimuli was constructed by changing one sentence at a time from the original higher readability stimuli. The primary focus was on sentence length and polysyllabic words of three syllables or more, with the rationale that there is an inverse correlation between ease of reading and academic level. Furthermore, the aim was to alter the tone of the article so it was perceived as less academic. Where possible only the polysyllabic word was changed unless it had impact on clarity of the sentence, in which case the sentence was re structured to improve clarity. These alterations were carried out by the researcher and a Special Educational Needs Teacher. (see Appendix 4, table of alterations).

The validation of the stimuli involved two processes, firstly, a Special Educational Needs (SEN) teacher – whose primary responsibility is to disseminate General Certificate of Secondary Education coursework to a level that children with special needs can understand – assisted with the restructuring of some sentences, and advised on synonyms to use.

Secondly, the two stimuli were tested to ascertain if they were significantly different, using a small sample of students within the same cohorts as the participants. This sample was asked to rate one or the other stimuli on whether the articles were articulate, well written, credible, and academically functional (Appendix 5). The questions were scored on a 7 point Likert scale. An ANOVA was conducted to discover if the stimuli were significantly different, the results are as follows;

$F(4,12) = 4.67, p = 0.03$ , showing that the stimuli were significantly different.

### **Manipulations**

Four manipulations of facts were made to the article *The Distributional Impact of the 2012–13, Higher Education Funding Reforms in England*, *Fiscal Studies*, 33, 2, 211–236 after norm rating.

The article refers to Brown review, 2012. This was changed to Brown review, 2001.

Repayment of student loan terms were changed from 25 – 30 years to 40 – 60 years.

Reduction in taxpayer funding was changed from 4.3 Billion – 3.2 Billion to 43 Billion – 32 Billion.

Collaborative partners were changed from Office for Fair Access (OFFA) to Office for Statistical Analysis (OFSA).

### **Procedure**

Participants were invited via email to the psychology laboratories (Luton campus) student private study rooms (Bedford campus & UCMK). The study ran over a week period with one day between each discussion forum. Following a briefing and presentation of a participant information sheet (Appendix 6) that stated that the research was looking at improving use of student discussion forums, informed consent was obtained (including permission to record discussions) (Appendix 7). Demographic information was collected via Qualtrics Survey Software using electronic tablets. Participants were asked to participate in a sequence of discussion groups after reading an article relating to student fees. They were advised that they would participate in one forum type (FTF or CMC) followed by a different forum type (CMC or FTF) the following day. No participants were made aware of different conditions. Regardless of initial forum type, participants were instructed to critically evaluate the article before reaching a group decision on questions that related to the accuracy and validity of the manipulated facts. They were advised that the answer had to



be the result of a group decision, and to critically discuss with each other until they had reached a decision. Once the group had reached a decision, their answers were recorded via Qualtrics, and the participants were presented with individual questionnaires (via Qualtrics), addressing the DV's. for quantitative analysis (Appendix 8). Those that participated in the initial FTF group started their discussions, whereas the participants that started in the CMC group were asked to start their discussions that evening and were provided with a chat room link.

The same procedure was repeated the following week in the alternate forum that groups had not participated in previously, the only difference between the forums was the stimuli was presented on paper in the FTF groups, which took place in the department of psychology research laboratories. Data was collected for the qualitative analysis by recording discussions on Dictaphone to be transcribe, whereas the stimuli was presented as a word document in the CMC condition, and the discussion took place in a chat forum established on <http://stinto.net>, when participants completed the discussion they were emailed Qualtrics link to complete questionnaires. The online scripts were copied into a word document and coded to ensure anonymity. Following participation in both forum types, participants were debriefed on the true nature of the study, and reminded of their right to withdraw for any reason. They were also advised that the audio recordings and the copied typed conversations would be anonymised before transcription. (Appendix 9: Debrief)

## **Ethics**

Research proposal and ethical clearance was sought from the research Centre for Applied Psychology (RCAP) at University of Bedfordshire and granted for the study to proceed (Appendix 10). Initially participants were not told that conformity was being measured in group settings with regard to written language. The reason for withholding this is that the awareness of the true nature of the study would bias the results, with participants being more aware and cancelling out any social influence. A full debrief page was presented with contact details of researcher, and participants were reminded of the right to withdraw.

### 3.3 Results

As can be seen from the table of means, there was very little variation on any of the dependant variables in either high or low readability conditions or the order of discussion forum, furthermore this extends to the differences between conformity assessments between and after conditions. All dependent variables were measured on a 7 point Likert scale and all the means are above the midpoint showing a ceiling effect. The higher the mean the higher the conforming behaviour. As there was not a significant result from the MANOVA below it can be argued that there was little variation in the mean scores.

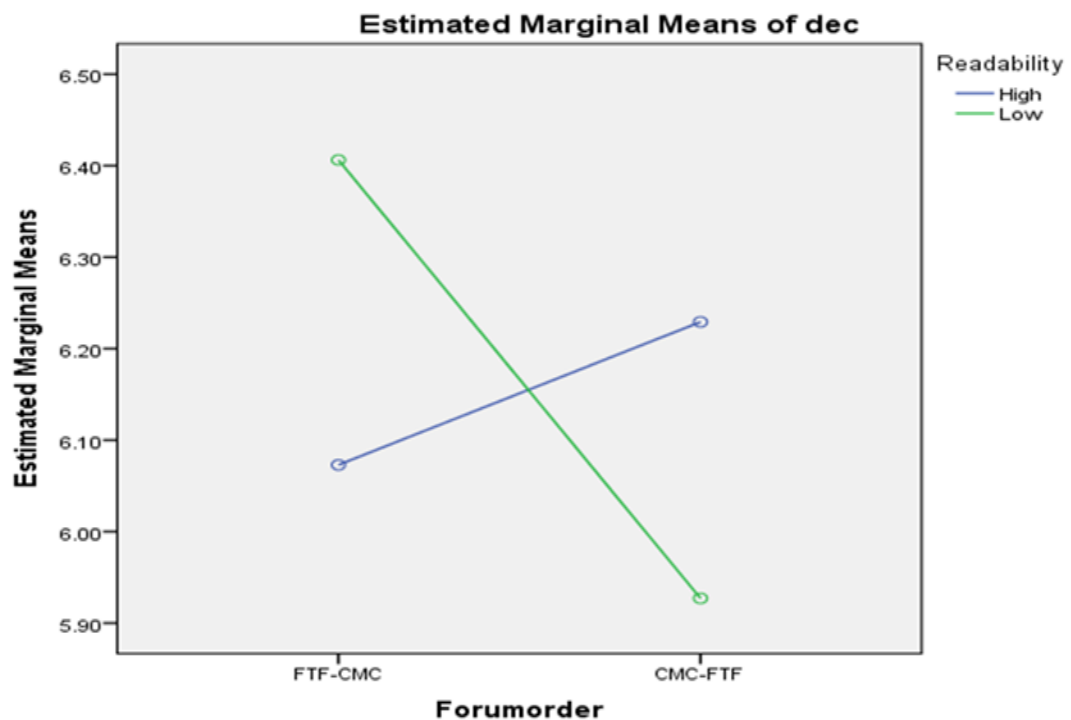
*Table 1. Descriptive Statistics of Dependant variable x Readability x forum order*

| Dependant Variable    | Readability | Forum Order | Mean | Std. |
|-----------------------|-------------|-------------|------|------|
| Consensus seeking 1   | High        | FTF-CMC     | 6.19 | 0.32 |
|                       |             | CMC-FTF     | 6.30 | 0.49 |
|                       | Low         | FTF-CMC     | 6.90 | 0.39 |
|                       |             | CMC-FTF     | 6.00 | 0.33 |
| Consensus seeking 2   | High        | FTF-CMC     | 6.21 | 0.42 |
|                       |             | CMC-FTF     | 6.35 | 0.41 |
|                       | Low         | FTF-CMC     | 6.30 | 0.32 |
|                       |             | CMC-FTF     | 6.10 | 1.03 |
| Decision confidence 1 | High        | FTF-CMC     | 5.94 | 0.43 |
|                       |             | CMC-FTF     | 6.27 | 0.42 |
|                       | Low         | FTF-CMC     | 6.54 | 0.38 |
|                       |             | CMC-FTF     | 5.83 | 0.31 |
| Decision confidence 2 | High        | FTF-CMC     | 6.20 | 0.41 |
|                       |             | CMC-FTF     | 6.19 | 0.36 |
|                       | Low         | FTF-CMC     | 6.27 | 0.36 |
|                       |             | CMC-FTF     | 6.02 | 1.03 |
| Membership group 1    | High        | FTF-CMC     | 6.00 | 0.39 |
|                       |             | CMC-FTF     | 6.25 | 0.41 |
|                       | Low         | FTF-CMC     | 6.52 | 0.36 |
|                       |             | CMC-FTF     | 5.85 | 0.33 |
| Membership group 2    | High        | FTF-CMC     | 6.10 | 0.38 |
|                       |             | CMC-FTF     | 6.29 | 0.38 |
|                       | Low         | FTF-CMC     | 6.20 | 0.30 |
|                       |             | CMC-FTF     | 6.00 | 1.03 |
| Pressure to conform 1 | High        | FTF-CMC     | 6.17 | 0.33 |
|                       |             | CMC-FTF     | 6.35 | 0.31 |
|                       | Low         | FTF-CMC     | 6.50 | 0.43 |
|                       |             | CMC-FTF     | 6.13 | 0.33 |
| Pressure to conform 2 | High        | FTF-CMC     | 6.04 | 0.45 |
|                       |             | CMC-FTF     | 6.35 | 0.25 |
|                       | Low         | FTF-CMC     | 6.31 | 0.27 |
|                       |             | CMC-FTF     | 6.12 | 1.08 |

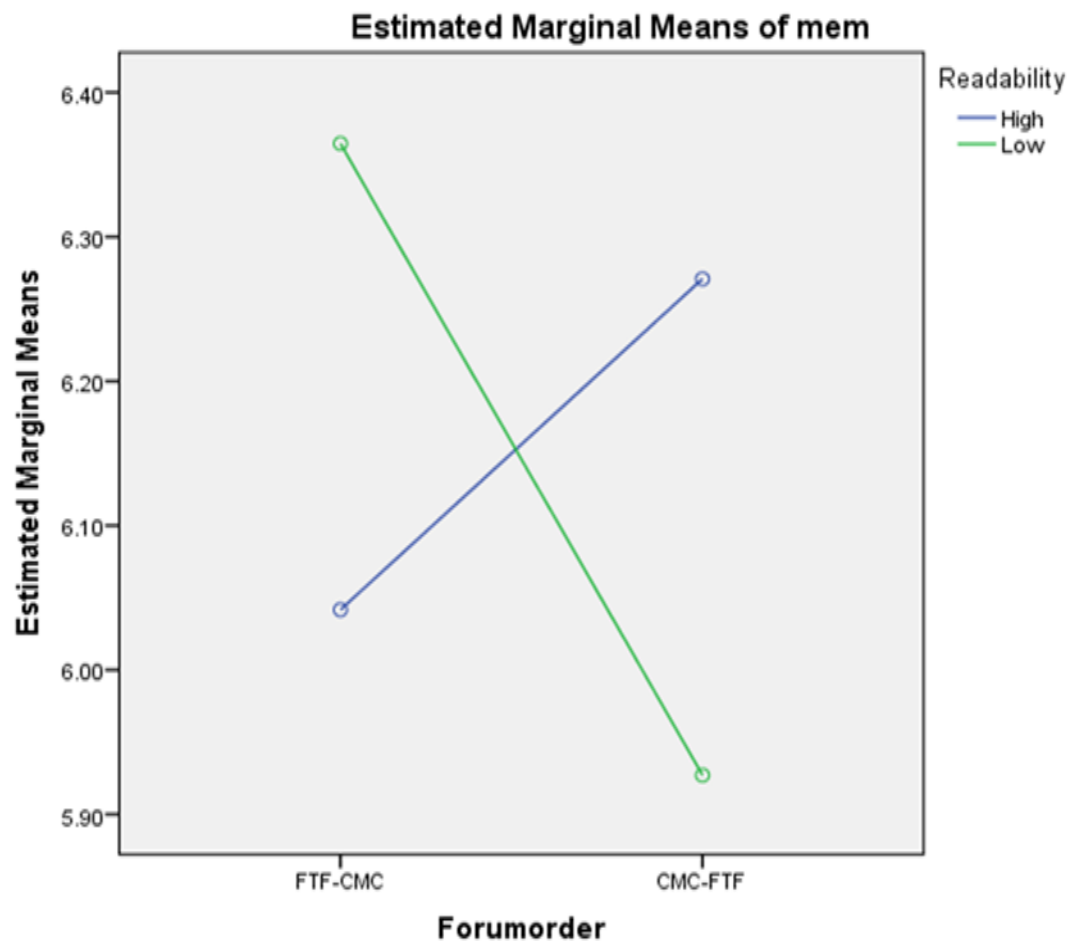
**Note:** The denotation of 1 and 2 refers to when the dependant variable was assessed, e.g. membership 1 was administered after 1st discussion forum and membership 2 after 2nd discussion forum.

To assess whether any of the conditions were statistically different a 2 (Readability; High vs Low) x 2 (Forum order; Face to Face (FTF) – Online (CMC) vs CMC - FTF) x 4 (Factual Manipulation: Date, Cash value, Time, Name) MANOVA was conducted using Pillai's Trace. There was not a significant difference of conformity between FTF discussion or CMC discussion or vice versa, neither was there significant differences between conformity checks,  $V = 0.15$ ,  $F(4, 41) = 1.81$ ,  $p = .15$ .

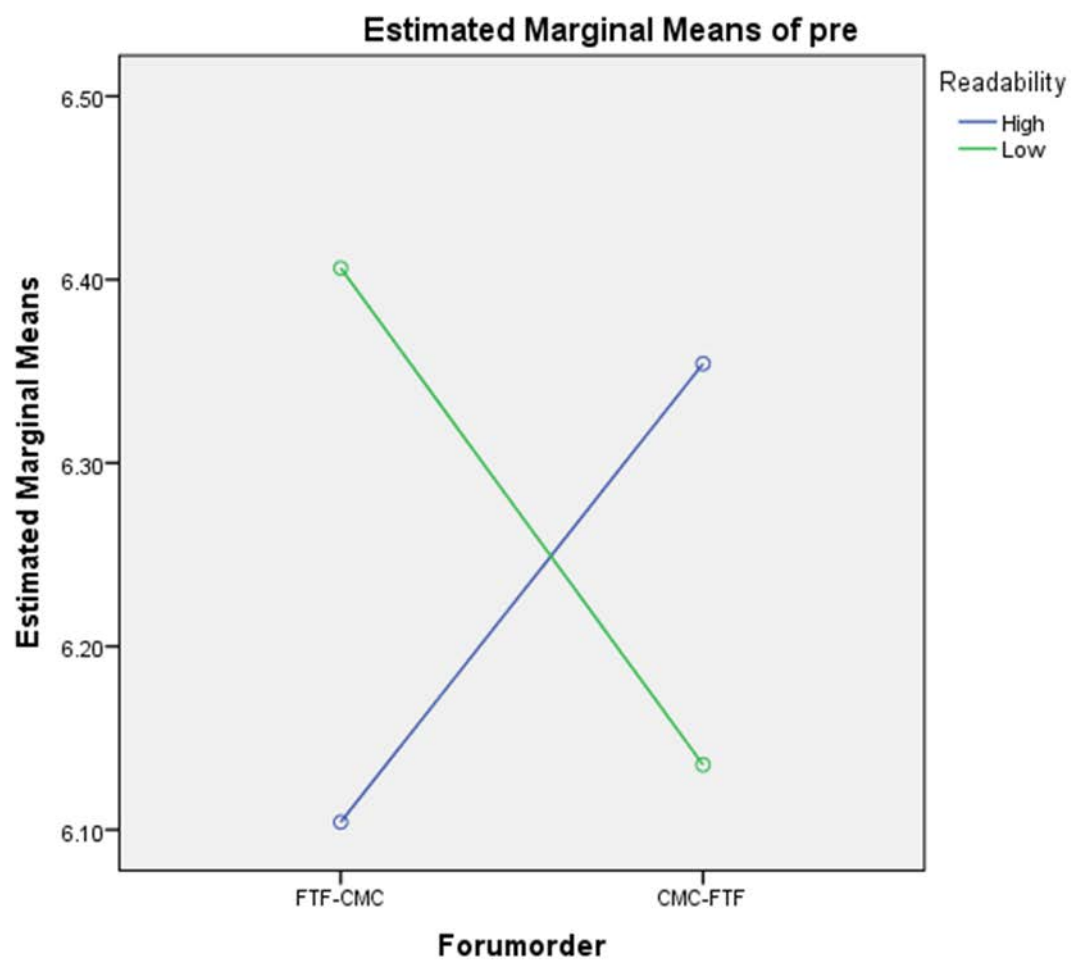
There was a significant interaction between readability of stimuli and order of discussion forum on the dependant variable decision confidence,  $F(4,44) = 7.63$ ,  $p = .008$ . This effect indicates that high and low readability were affected differently by forum order. Specifically, the levels of conformity in low readability were lower in CMC-FTF than FTF-CMC;



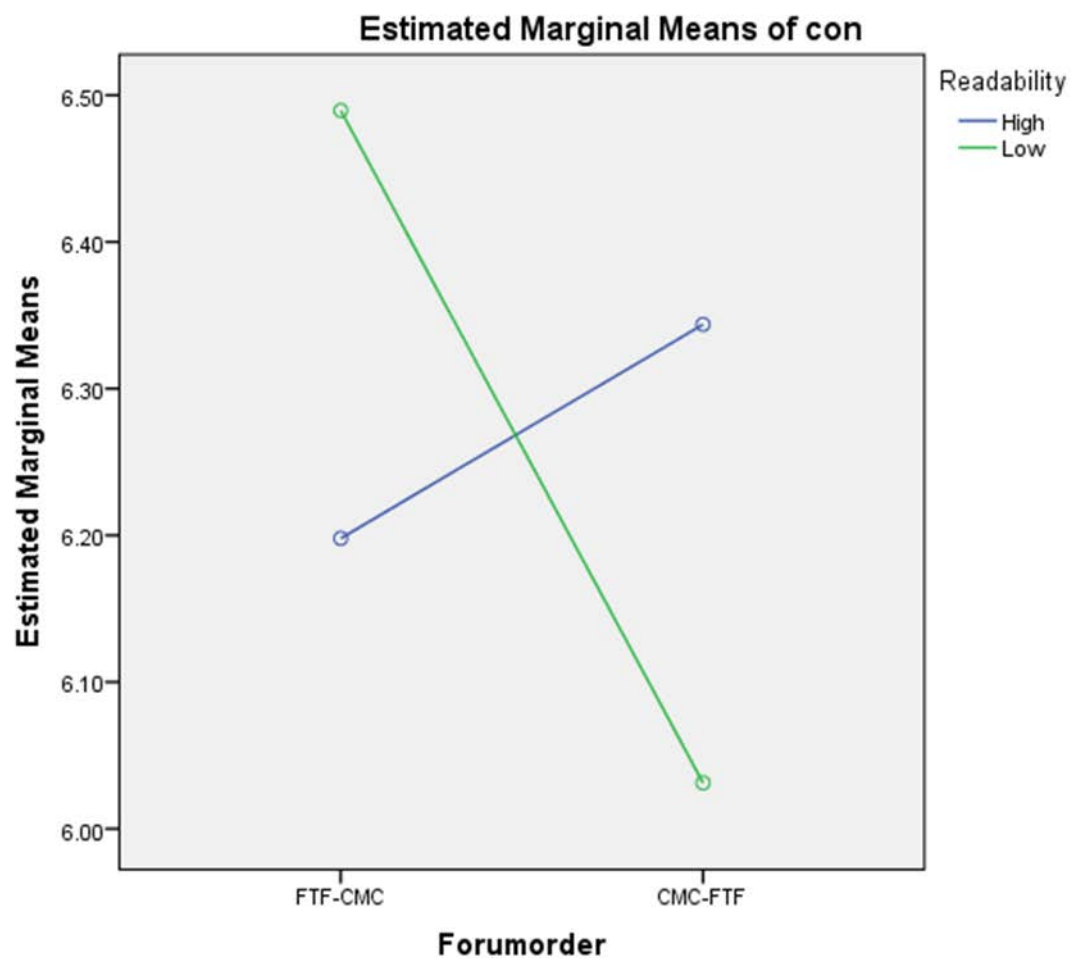
There was a significant interaction between readability of stimuli and order of discussion forum on the dependant variable membership,  $F(4,44) = 9.37$ ,  $p = .004$ . This effect indicates that high and low readability were affected differently by forum order. Specifically, the levels of conformity in low readability were lower in CMC-FTF than FTF-CMC;



There was a significant interaction between readability of stimuli and order of discussion forum on the dependant variable pressure to conform,  $F(4,44) = 11.10$ ,  $p = .002$ . This effect indicates that high and low readability were affected differently by forum order. Specifically, the levels of conformity in low readability were lower in CMC-FTF than FTF-CMC;



There was a significant interaction between readability of stimuli and order of discussion forum on variable consensus seeking,  $F(4,44) = 7.06$ ,  $p = .01$ . This effect indicates that high and low readability were affected differently by forum order. Specifically, the levels of conformity in low readability were lower in CMC-FTF than FTF-CMC;



## **Data Analysis**

Specific questions were posed to the group, followed by a free unguided discussion and interviews were recorded using a Dictaphone and later transcribed in FTF groups and text copied into word for CMC groups. Transcripts were analysed using thematic analysis, a qualitative method used for 'identifying, analysing and reporting patterns (themes) within data' (Braun & Clarke, 2006. P76.). On analysis of each of the discussion group, a coding framework was devised. This report is structured in terms of the main themes and subthemes that emerged from the discussion groups. Semantic themes, that is, themes that are at the surface of the data, are used, as opposed to latent (hidden) themes, as latent themes appear to submerge at a more subjective level and rely on assumptions and ideas, whereas making use of semantic themes seems more objective and accurate, in scientific terms (Braun and Clarke, 2006).

## **Thematic Analysis**

During the course of the 12 discussion groups participants discussed the article on student fees, the accuracy and quality of the article and how it applied to them. They discussed the manipulated facts, focussing specifically on the repayment period of the loans, although the participants for the most part gave equal attention to all points covered in the article. The participants gave their individual views on the article and worked towards reaching a group consensus. During the discussions there was evidence of elements of critical thinking, namely, questioning, evaluation and reflection. In some cases, participants were unaware of some information and turned to their peers for confirmation. In some cases, individuals took "charge" of the group and became directive of their peers. In some cases, but not all, where the participant expressed doubt or lack of knowledge, their opinion either changed or they accepted that of the group as being true. The difference in readability conditions could be summed up in the following statement in regards to the low readability stimuli

"This must have been some shoddy journal that published this".

The following analysis outline the main themes and subthemes that emerged from the discussion groups. Semantic themes, that is, themes that are at the surface of the data, are used, as opposed to latent (hidden) themes, as latent themes appear to submerge at a more subjective level and rely on assumptions and ideas, whereas making use of semantic themes seems more objective and accurate, in scientific terms (Braun and Clarke, 2006).

## Critical thinking

### Questioning

Generally, the questioning was good, with the participants questioning not only the manipulated facts but each other. "Are you sure about the agency involved? I think it's something else" (Group 8, participant 1). Although this happened less frequently in the CMC groups, with participants more willing to challenge each other in the FTF environment. The higher quality discussions around the "facts" were prompted by simple open ended questions "so what does everyone think?" (Group 10, participant 3, CMC), leading to an open discussion by the group, with each contributing opinions and making statements regarding the various issues being discussed. In some cases, the discussions were stilted or short and took a bit of effort to stimulate, these were generally started with closed questions "Is the reduction in subsidy correct?" (Group 7, participant 4, CMC). These groups demonstrably had less in depth discussions and covered the material in shorter time, due to the inevitable yes or no answers elicited from these questions.

Many participants had quite a good knowledge in the area regarding the background of student loans and for the most part queried the manipulated facts, feeling that there was *"something not quite right about this article"* (Group 5, Participant 1, FTF) about the information in the article, particularly the repayment period manipulation. There was a sense that it was excessively long *"That's wrong, I'll be a pensioner before I pay that off, does anyone else think so?"* (Group 2, Participant 4 CMC) and uncertainty about the accuracy of the presented information *"that's way too long, didn't we have a discussion with the student union about this?"* (Group 1, participant 1, FTF).

For most participant groups a discussion ensued regarding the length of repayment period, with a number of participants prompting quite an in-depth discussion *"I think we should discuss this, what does everyone think of the length of time"* (Group 3, participant 2, FTF). Although the participants did discuss the repayment issue they more often than not failed to acknowledge that the article could be wrong, with most of the groups finalising the issue by stating that the article was published and peer reviewed *"we must be wrong, isn't this a published article? Would it get published if it was inaccurate?"* (Group 2, participant 2, FTF). The general consensus amongst all groups and participants was that the information was correct as it was peer reviewed and published.



## Evaluation of material

Generally speaking, most participant groups showed some level of evaluation, this however varied greatly between groups and environments. Often poor evaluation was shown with statements being mainly descriptive *“office for national statistics, it’s this obsession with stats!”* (Group 12, participant 3, FTF). As a whole the groups that generated the more descriptive analysis were FTF groups assuming that the evidence provided within the article was correct and that the evidence was just simply there to be discussed. The participants in the CMC groups provided higher quality evaluation in that they made clearer statements that attempted to use evidence to qualify their statements *“I think the reduction in subsidies by 11 billion justifies the rise in tuition fees”* (Group 7, participant 1, CMC). In most groups and across all the manipulations this was the case *“The repayment period extension is because the amount you earn before repaying has risen!”* (Group 11, participant 4, CMC), again the focus leaned heavily towards discussion of the loans, *“yeah, the loans get written off after a period of time, which is why the repayment period has changed so much!”* Although the evaluation was of a better quality in the CMC environment all groups had the tendency to simply discuss the article as fact and be more assumptive and generalise; most of the evaluative statements were to accept and justify the manipulated facts.

## Reflection

Critical reflection was surprisingly absent from the majority of the discussions, although there were examples of critical reflection in all environments and in both conditions, these were sporadic and in most cases went unheeded by other participants. The higher incidents of critical reflection were observed in the low readability and online conditions with one example standing out amongst others *“well, the fees have risen and the repayment period has increased, we’re in disagreement about the length of repayment, how can this be resolved”* (Group 4, participant 3, CMC). This one statement offered within the reflective framework of “what, so what, now what” stimulated lengthy discussion with the group concerned debating the issue almost exclusively over any of the other questions.

For the most part participants personally reflected on their own knowledge *“I’m sure the subsidy isn’t that much, why do I think its lower? What was the article I read?”* (Group 9, participant 2, FTF). These statements went generally undiscussed and the participants themselves didn’t follow through on their reflective statements, allowing the discussion to

continue without further thought to what could have generated an evidence based discussion.

## **Social Influence (Conforming behaviours)**

### **Majority influence**

Most participants discussed the article tentatively initially, whilst waiting for the remaining group members to state their views, once the groups views were known the discussion became open. However, once participants had stated their positions a number of participants changed their positions following discussion with group members, *"you seem to know what you're talking about"* (Group 3, participant 4, FTF). The longer the discussion continued the greater the consensus developed with more participants changing position and doubting their own original position *"actually, I think you're right"* and *"you know I've just remembered that it has changed"* (group 12, participant 1, FTF). A participant that had only just received their finance agreement after months of issues *"I'm sure that I've signed a shorter agreement,"* (Group 8, participant 3 FTF) in relation to repayment period. Whereas other participants were sure of their positions but still complied with the majority to achieve a consensus, *"I know I'm not wrong, but hey whatever"* (Group 7, participant 1, FTF) similarly, *"I don't think I'm mistaken, I'll agree though."* (Group 6, participant 4, CMC). Most participants that contested the accuracy of the group position gave very little in way of argument to conform to the group consensus.

### **Expertise**

A number of participants who seemed sure of their positions were swayed by other members of the group, in most cases this was due to individual participants assuming a position of knowledge where they argued successfully that their position was correct *"I had to do a presentation on this very thing in college, I know I'm right as I got a good mark"* (Group 1, participant 4, FTF) , another participant *"I spent ages with my parents telling me all about it, they're never wrong"* (Group 2, participant 1, CMC). This level of assertiveness and confidence in a position had other participants querying their own knowledge and agreeing, whether agreement was private as well as public is not clear, *"I guess it's realistic, I know it's over a longer period from the original finance loans and if you're sure"* (Group 1,

Participant 2, FTF). The net result of these discussions were agreement with the participant that assumed a position of knowledge.

### **Obedience**

From the outset of the discussion the majority of the participants simply accepted that their knowledge surrounding the issue of fees and its background was wrong, *"I didn't think it was that long, but the article is published so it must be correct"* (Group 7, participant 1, FTF). Quite a few participants unquestionably stated that *"it's a peer reviewed journal of course it's right"* (Group 3, participant 4, CMC) even when participants held opposing beliefs they felt as if their opinions were incorrect due to the oft cited statement of *"it's a peer reviewed and published journal."* This was true for both CMC and FTF conditions and the low versus high readability conditions.

## **3.4 Discussion**

The aim of this study was to investigate the effect of social influence on critical thinking in a blended learning environment and to investigate whether the presentation of written language also effected conformity. It was hypothesised that social influence would interfere with critical thinking, that there would be higher levels of conformity in FTF when compared to CMC and that Conformity would be higher in the high readability conditions when compared to the low readability conditions regardless of forum order. Conformity was measured on four dependant variables, which were pressure to conform to the group's decision (1), that participants would reason they conformed to reach a consensus (2), for membership of the group (3) and participants being confident in their decisions (4). The results showed that hypothesis two and three was not proven as there was no difference between discussion groups regardless of the initial order or level of readability in relation to conforming to the manipulated facts. However, hypothesis one appears to be met, with participants conforming in all conditions regardless of the order of discussion or level of readability, as can be seen by the means.

In terms of the initial forum orders, for FTF the results could support the assertions of several researchers (see Hodges & Geyer, (2006) for a review), that there is a possibility that conformity has been found in several studies due to the use of confederates and the presence of the researcher. This study addressed this issue by utilising a "true" group and leaving the group to complete the task alone. This might suggest that confederates and

researcher presence are possibly a cause of conformity in laboratory studies. In fact Asch (1956) found that just with the replacement of one confederate for a true participant conformity rates dropped significantly. This was also an issue for Crutchfield (1955), who developed a closed booth paradigm to remove the influence of visible confederates and social cues, he however did find conformity using virtual confederates.

Leading to the Initial CMC condition, the findings seem to support early conformity research which suggested that there is no significant conformity in a CMC environment (Smilowitz et al. 1988). The argument here being that there is no conformity in CMC as there is not a physical presence, salient social presence or social identity. These factors coupled with anonymity allow for greater freedom of expression (McKenna & Green, 2002). The asynchronous format of the forum allows more time to reflect before responding to group members, possibly reducing the conforming behaviours (Guiller et al. 2006). In terms of critical thinking, this finding supports the literature, with the finding that there is greater reflection and interlinking of ideas within the online environments (Guiller et al., 2006: Wang 2005) and higher quality argumentation (Joiner & Jones 2003)

The anonymity experienced in the initial CMC conditions cannot be attributed for the groups that participated in the FTF groups before continuing the study in a CMC environment as each group member had spent time discussing the stimuli and as such were identifiable and had potentially developed a group identity. It would be expected that the initial FTF condition would allow a greater number of ideas and wider range of critical discussion to develop (Guiller et al., 2006: Wang 2005: Yu et al., 2015) and this would be followed by greater reflection and well thought out arguments in the CMC condition (Guiller et al., 2006: Costley 2016). It is reasonable to assume that this would show a greater variation in the means between conforming measures. The reverse is also true of the initial CMC followed by FTF. These participants would have been expected to develop a well thought out critique before a wider discussion in the FTF condition. It must also be noted that after each condition each group had to reach a group consensus on the accuracy of the manipulated facts, before being assessed individually, this may have had an impact on the conforming for consensus measure. Every group agreed to the manipulated facts regardless of readability or forum order and so must have conformed at the very least to dependant variable 1 which was to reach a group consensus.

To investigate further an examination of the means of the dependant variables, it can be seen that every participant conformed regardless of readability condition or order of forum. Conforming to a group consensus shows high conformity in both FTF-CMC and CMC-FTF in both high and low readability conditions, possibly supporting the idea of conforming to group goals (Buehler & Griffin, 1994). High readability CMC-FTF (6.30) saw higher levels of conforming behaviour than FTF-CMC (6.19) which is counter intuitive to the literature, with FTF generally seeing up to double the levels of conformity than CMC (Cinnirella & Green, 2006). A possible reason, the feeling of anonymity, can lead to group members conforming to a greater degree to group norms than they may have otherwise (Reicher, Spears & Postmes, 1995). In the low readability condition the levels were reversed with FTF (6.90) higher than CMC (6.00), although with a noticeable variability it wasn't significant, but holding true to the literature showing FTF having higher conformity levels than CMC. The variability between high and low readability shows very little difference unlike Ward (2014) who showed significantly higher levels of conformity in a higher readability condition. This pattern is maintained in the second assessment of consensus seeking following the second discussion groups with very little differences between assessment points; it is also maintained across all of the dependant variables, showing that regardless of initial forum order participants maintained their decisions into second discussion group.

Looking at the interactions it can be seen that conformity was significantly lower in the low readability group in the CMC-FTF condition compared to the FTF-CMC condition across all dependant variables. So a combination of the order of forum produced a significant effect in reduction of conformity when CMC was initiated first. (Smilowitz et al, 1998; Cinnirella & Green, 2000; Laporte et al, 2010) all reported lower conformity in the CMC compared to FTF. This finding supports previous research in regards to discussion environment that there is less conformity in CMC. The findings regarding language are contrary to research that suggests a higher readability condition should see higher conformity as participants perceive a more coherent style as credible and expert (Brashers, 1995). An explanation for this could well be that participants viewed the stimuli in the low readability condition as easier to read and more straightforward as opposed to articulately correct academic writing.

## **Summary and conclusion**

From the thematic analysis, a number of processes can be seen that may explain why there were no differences between conditions, insofar as everybody conformed. The primary process that stood out was another form of social influence in the form of obedience to authority, which can be defined as following direct or indirect instructions from a real or perceived authority figure (Coleman, 2009). It can reasonably be asserted that the participants' referral to the article being peer reviewed and published is a form of obedience to authority. Similar to Milgrams (1961) participants acting against their conscience, participants in this study acted against what they thought to be true, due to the status (authority) of the presented stimuli. Cadsby, Maynes & Trivedi (2006) in their study merely text messaged falsely whilst purporting to be a tax authority, advising that the participant neighbours had paid their tax returns. They found that participants started paying their tax returns. From these studies we can make a reasoned judgement that a peer reviewed article has been seen as an "authority" and as a powerful social influence has been the dominant process in this study.

That being said, other, expected social influence was also found in that participants did conform to the majority for a number of reasons. Mori & Arai, (2010) presented false information and found their participants conformed for several reasons, to agree with the majority, forming a consensus and being unsure of the correct information. Predominately participants conformed to form a consensus and to maintain group goals. The thematic analysis showed participants indeed agreed with the majority for both consensus seeking and when unsure, several participants took the position of "expert" in relation to their assertions that the information was correct (especially loan repayment manipulation) and the unsure participants agreed with the "expert". In some cases, participants convinced themselves that the "expert" was indeed correct. This was similar to Buehler & Griffin (1994) where participants were free to discuss content and changed views to achieve a common goal and develop an agreement. A number of participants somewhat disagreed with the group but conformed to reach a consensus as individuals will often agree, whilst privately disagreeing, when the desire for consensus and membership outweighs their own opinions (Deutsch & Gerard, 1955). Quite a few participants in this study were either unsure of information or were swayed by the more "knowledgeable" peers, demonstrating informational social influence (Pendry & Carrick, 2001). These processes were possibly

magnified by the influence of authority, which accounts for the extreme conforming behaviours and accounting for no significant differences between groups.

An important finding in this study was the interaction between readability and forum order: across all the dependant variables a significant interaction could be seen showing lower levels of conformity for participants for whom the CMC was the initial experimental stage. This is important in that it demonstrates that in a student learning environment the order tasks are presented needs to be assessed. These findings suggest that an online activity followed by a tutorial will be off greater benefit to the student and reduce conforming behaviours. Even though elements of critical thinking could be seen in both FTF and CMC environments, it would seem that obedience to authority in this case has over ridden this developing. To further this study and to attempt to remove the influence of obedience a further study needs to be conducted with consideration on removing obedience. Its proposed that the stimuli be altered slightly, in that the journal article title be removed and the stimuli be presented as a student opinion piece in the hope that the constraining factor of the stimuli being a peer reviewed piece is no longer taken into consideration and the original hypothesis can be addressed.

## Chapter 4 Study 2

### 4.1 Introduction

Following on from the previous study where the aim was to examine whether social influence interfered with critical thinking in a blended learning environment, using a critical thinking task with stimuli that had had the readability level manipulated between Low readability and high readability. This study attempts to moderate for an unexpected variable found in the previous study, namely obedience to authority. Using the same stimuli, but with the article title removed and presented as an opinion piece, this study hopes to achieve the aim of study one.

### 4.2 Methods

#### **Participants**

Forty-eight undergraduate and postgraduate students from the University of Bedfordshire participated in this study (School of Psychology, Business School, Education Studies, Computing, Health and Social Studies, Applied Social Studies). The sample consisted of 28 (58.3%) females/20 (41.7%) males, aged 19 -38 mean 24.20(4.35), all participants were

students eligible for student finance, Students that were sponsored or paying for the cost of their education were excluded from the study due to the reasonable assumption that they less likely to of paid close attention to the changes made in student funding.

The remaining methodology for study two was the same as study one barring the removal of the article title (including authors) and the advising that the article was a student opinion piece, see appendix.

### 4.3 Results

As can be seen from the table of means, there was very little variation on any of the dependant variables in either high or low readability conditions or the order of discussion forum, furthermore this extends to the differences between conformity assessments between and after conditions. All dependent variables were measured on a 7 point Likert scale and all the means are above the midpoint showing a ceiling effect. The higher the mean the higher the conforming behaviour. As there was not a significant result from the MANOVA below it can be argued that there was little variation in the mean scores.

*Table 2. Descriptive Statistics of Dependant variable x Readability x forum order*

| Dependant Variable    | Readability | Forum Order | Mean | Std. |
|-----------------------|-------------|-------------|------|------|
| Consensus seeking 1   | High        | FTF-CMC     | 5.60 | 1.15 |
|                       |             | CMC-FTF     | 5.35 | 1.95 |
|                       | Low         | FTF-CMC     | 6.59 | 0.53 |
|                       |             | CMC-FTF     | 4.7  | 0.79 |
| Consensus seeking 2   | High        | FTF-CMC     | 6.06 | 0.56 |
|                       |             | CMC-FTF     | 5.73 | 1.44 |
|                       | Low         | FTF-CMC     | 5.23 | 1.04 |
|                       |             | CMC-FTF     | 5.23 | 1.09 |
| Decision confidence 1 | High        | FTF-CMC     | 5.02 | 1.28 |
|                       |             | CMC-FTF     | 5.21 | 1.90 |
|                       | Low         | FTF-CMC     | 6.54 | 0.42 |
|                       |             | CMC-FTF     | 4.50 | 0.90 |
| Decision confidence 2 | High        | FTF-CMC     | 6.06 | 0.59 |
|                       |             | CMC-FTF     | 5.27 | 1.61 |
|                       | Low         | FTF-CMC     | 5.10 | 1.17 |



|                       |      |         |      |      |
|-----------------------|------|---------|------|------|
|                       |      | CMC-FTF | 5.10 | 2.29 |
| Membership group 1    | High | FTF-CMC | 4.79 | 1.29 |
|                       |      | CMC-FTF | 4.98 | 2.13 |
|                       | Low  | FTF-CMC | 6.56 | 0.39 |
|                       |      | CMC-FTF | 4.52 | 0.96 |
| Membership group 2    | High | FTF-CMC | 5.88 | 0.61 |
|                       |      | CMC-FTF | 5.54 | 1.33 |
|                       | Low  | FTF-CMC | 5.29 | 1.04 |
|                       |      | CMC-FTF | 5.27 | 2.28 |
| Pressure to conform 1 | High | FTF-CMC | 4.54 | 1.49 |
|                       |      | CMC-FTF | 5.04 | 2.05 |
|                       | Low  | FTF-CMC | 6.00 | 1.53 |
|                       |      | CMC-FTF | 4.65 | 1.39 |
| Pressure to conform 2 | High | FTF-CMC | 3.88 | 2.04 |
|                       |      | CMC-FTF | 4.10 | 1.73 |
|                       | Low  | FTF-CMC | 4.29 | 1.48 |
|                       |      | CMC-FTF | 3.92 | 2.40 |

Note: The denotation of 1 and 2 refers to when the dependant variable was assessed, e.g. membership 1 was administered after 1st discussion forum and membership 2 after 2nd discussion forum.

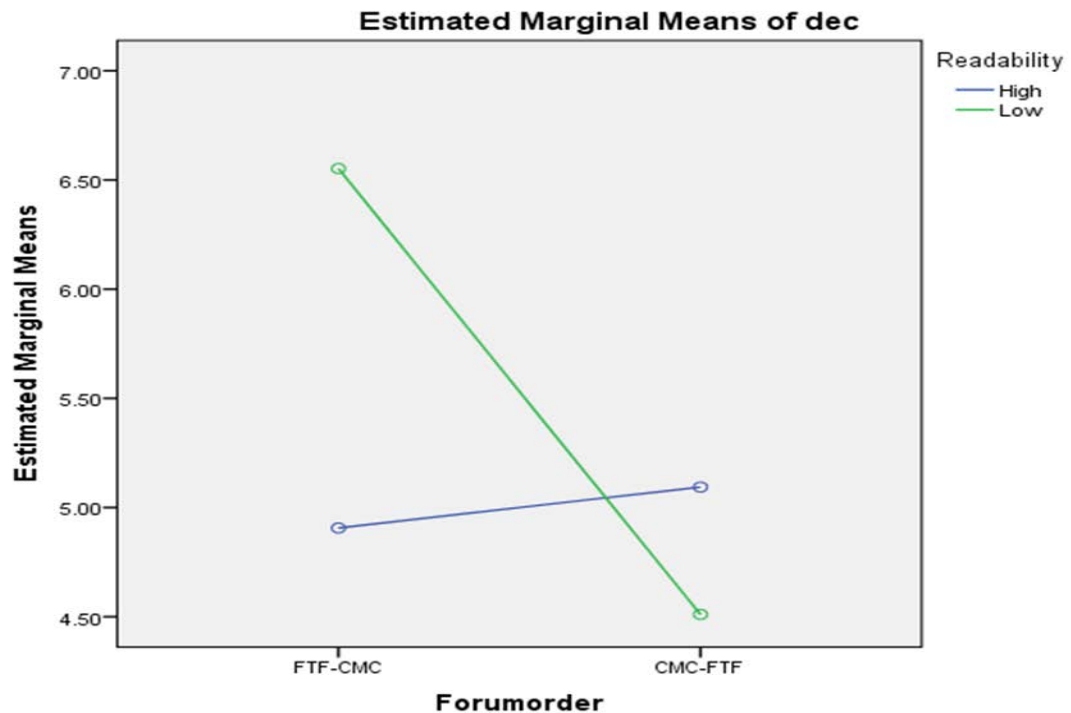
To assess whether any of the conditions were statistically different a 2 (Readability; High vs Low) x 2 (Forum order; Face to Face (FTF) – Online (CMC) vs CMC - FTF) x 4 (Factual Manipulation: Date, Cash value, Time, Name) MANOVA was conducted using Pillai's Trace, there was not a significant effect of conformity between FTF discussion or CMC discussion or vice versa, neither was there significant differences between conformity checks,  $V = 0.13$ ,  $F(4, 41) = 1.48$ ,  $p = .23$ .

There was a significant main effect of forum order in relation to decision confidence  $F(4,44) = 7.30$ ,  $p = .01$ . Showing that confidence in decision on the manipulated variables was significantly lower in the CMC-FTF

There was an emerging significance of forum order in relation to consensus seeking  $F(4,44) = 3.79$ ,  $p = .58$ , showing that consensus seeking was almost significant in CMC-FTF

There was a significant interaction between readability of stimuli and order of discussion forum on the dependant variable decision confidence,  $F(4,44) = 10.55$ ,  $p = .002$ . This effect indicates that high and low readability were affected differently by forum order.

Specifically, the levels of conformity in low readability were lower in CMC-FTF than FTF-CMC



### Data Analysis

Specific questions were posed to the group, followed by a free unguided discussion and interviews were recorded using a Dictaphone and later transcribed in FTF groups and text copied into word for CMC groups. Transcripts were analysed using thematic analysis, a qualitative method used for 'identifying, analysing and reporting patterns (themes) within data' (Braun & Clarke, 2006). On analysis of each of the discussion group, a coding framework was devised. This report is structured in terms of the main themes and subthemes that emerged from the discussion groups. Semantic themes, that is, themes that are at the surface of the data, are used, as opposed to latent (hidden) themes, as latent themes appear to submerge at a more subjective level and rely on assumptions and ideas, whereas making use of semantic themes seems more objective and accurate, in scientific terms (Braun and Clarke, 2006).

## **Thematic Analysis**

The removal of the journal article title and authors saw the anticipated effect, in that obedience to authority was changed. During the course of the 12 experimental groups (24 discussions), participants discussed and evaluated the presented stimuli without reference to a peer reviewed journal or published article, so clearly the manipulation worked. The themes that emerged from the discussion centred on achieving a consensus and group goals, most participants had a good knowledge of the background to student finance and in most cases agreed with the stronger or more outspoken members of the group. So participants either changed their opinion to form a consensus whilst privately disagreeing or changed their opinion both publicly and privately. A desire for accuracy was also noted in discussion following secondary forums, in that participants in some cases conformed to higher levels, stating that *"I'm even surer"* (Group 2, participant 3, CMC).

## **Critical thinking**

### **Questioning**

The levels of questioning were a lot higher than in the previous study, participants freely questioned the article and the manipulated facts within it. The discussion was a lot more freely flowing as the participants were comfortable questioning what they viewed as an opinion piece, especially in the low readability conditions *"I agree with a lot that's been written, but are some of these questions are wrong?"* (group2, participant 4, FTF). The discussion centred around not only the manipulated facts but also around the author, dependent upon condition *"do you think this is a teacher or a student?"* (Group 12, participant3, FTF). Although the level of questioning was higher which prompted greater discussion and levels of argumentation, the type of questions changed slightly with more closed questions being stated *"the repayment period is wrong isn't it?"* (group 7, participant 1, CMC). The participants were showing more willingness to assert their opinions as opposed to floating an idea in the form of a question.

The focal point in most of the discussion was the repayment period manipulation with all groups having a discussion around this point. Participants openly questioned the article and each other in regard to what appeared to be a contentious issue *"How can you say it's wrong? The fees have increased so the repayment periods been extended, it makes sense doesn't it?"* (Group 1, participant 1, FTF). Many participants disagreed with each other and questioned credibility of their peers' opinions *"How do you know this is correct?"* (Group10,

participant 3 CMC). Overall, questioning within the FTF group was more argumentative than CMC, whereas participant disagreed in the CMC groups but in more statement form.

### **Evaluation of material**

As a whole the groups that generated the more descriptive analysis were FTF groups assuming that the evidence provided within the article was simply an opinion piece participants simply gave their own opinions without weighing up the evidence *"The subsidies are massive, so you can see why fees have gone up"* (Group 5, participant2, FTF). The participants in the CMC groups offered very little in way of higher quality evaluation in that they also offered statements of opinion without feeling the need to evaluate the material. In most groups and across all the manipulations this was the case; participants seemed to be happy to make statements when not arguing over the repayment period. All groups had the tendency to simply discuss the article as fact and be more assumptive and generalise; most of the evaluative statements were to accept and justify the manipulated facts.

### **Social Influence (Conforming behaviours)**

#### **Majority influence**

Most participants discussed the article initially with a high level of argumentation that seemed more about who was right than the task at hand. Eventually a consensus started to form and the discussion became more task related than group related. *"OK, so most of us agree that this is right"* (Group 8, participant 4, CMC), increasing group pressure for the remaining member to decide. The dissenting group member eventually agreed with the majorities decisions, although, it was public agreement and probably not a change of opinion *"I don't think I'm wrong, however, if everyone else is agreeing"* (Group 8, participant 1, CMC). This being said, a few participants that were assertive in their disagreement with the group seemed to change their opinion and accept that they were wrong *"maybe I'm wrong, there's so much to remember"* (group 4, participant 4 FTF), seemingly an opinion change as opposed to consensus seeking.

#### **Expertise**

A number of participants who seemed sure of their positions were swayed by other members of the group. In most cases this was due to individual participants assuming a position of knowledge where they argued successfully that their position was correct *"We had a meeting with the SU during fresher's"* (Group 6, participant 1, FTF). This level of assertiveness and confidence in a position had other participants querying their own

knowledge and agreeing, whether agreement was private as well as public is not clear, *"Well your knowledge is obviously more current than mine"* (Group 1, Participant 2, FTF). Participants in most cases were quick to agree with the more assertive opinions and those that claimed to have a position of knowledge on the subject. Not many participants stood their ground for anything other than a cursory objection, almost as if they didn't want to be the "odd one out".

#### 4.4 Discussion

The aim of this study was to remove an unexpected influence of obedience to authority found in a previous study that was investigating whether social influence interferes with critical thinking and the effect of language on conformity. It was hypothesised that participants would conform to a greater degree in a high readability condition, that conformity would be higher in FTF-CMC condition when compared to CMC-FTF condition and that conformity would drop in the second forum regardless of initial order. Finally, that social influence in the form of conformity would interfere with critical thinking during group discussions. Conformity was measured on four dependant variables, which were pressure to conform to the group's decision (1), that participants would reason they conformed to reach a consensus (2), for membership of the group (3) and participants would have confidence in their decisions (4). To explore the previous studies finding of obedience to authority the stimuli was manipulated and the title and authors removed. The results showed that the manipulation was successful, in that there were no indicators of obedience to authority. The hypothesis that social influence would interfere with conformity would appear to of been met, in that all participants conformed regardless of conditions. The remaining hypothesis were not met as there was no difference between discussion groups regardless of the initial order or level of readability in relation to conforming to the manipulated facts.

Similarly, to study 1 the FTF results could support the assertion that conformity studies only find conformity due to the use of confederates (Hodges & Geyer, 2006). However, a number of recent research studies have found conformity in traditional groups as well as virtual without using confederates (Rosander & Eriksson 2012: Beran et al 2015). With the removal of the journal title the influence of obedience to authority appears to have been removed. However, other than an increased level of argumentation the participants offered very little in way of evaluation, reflection and seemed to respond in statements. This seems to support the idea that for some an online discussion is simply to comment

and not discuss (Wise, Speer, Marbouti, & Hsiao, 2013). In terms of critical thinking, this finding supports the literature, with the finding that there is greater reflection and interlinking of ideas within the online environments (Guiller et al., 2006; Wang 2005) and higher quality argumentation (Joiner & Jones 2003).

To investigate further an examination of the means of the dependant variables, it can be seen that every participant conformed regardless of readability condition or order of forum. Conforming to a group consensus shows high conformity in both FTF-CMC and CMC-FTF in both high and low readability conditions, possibly supporting the idea of conforming to group goals (Buehler & Griffin, 1994). High readability CMC-FTF (5.35) saw higher levels of conforming behaviour than FTF-CMC (5.60) which follows the literature, with FTF often seeing up to double the levels of conformity than CMC (Cinnirella & Green, 2006). In the low readability condition the means were even further apart with FTF (6.59) higher than CMC (4.7), although with a noticeable variability it wasn't significant, but holding true to the literature showing FTF having higher conformity levels than CMC.

The variability between high and low readability shows very little difference unlike Ward (2014) who showed significantly higher levels of conformity in a higher readability condition. This pattern is maintained in the second assessment of consensus seeking following the second discussion groups with very little differences between assessment points; it is also maintained across all of the dependant variables, showing that regardless of initial forum order participants maintained their decisions into second discussion group. An interaction was found showing that low readability condition saw a significantly lower level of conformity in confidence of decision in CMC-FTF than FTF-CMC, so a combination of the forum orders induced a significant effect.

### **Summary and Conclusion**

The removal of the article title had the anticipated effect and removed obedience to authority from the discussion, although there was no significant difference between conditions its clear to see from the table of means (table 2) and the thematic analysis that various conforming behaviours could be seen. Predominately conforming for a consensus and to facilitate group goals which supports the current literature in the area, it could be seen from the thematic analysis that a high number of participants appeared happy to either forego their own opinion to facilitate a group decision. although the language conditions and forum orders had no impact on the outcome, informational and normative social influence could be seen, with conforming behaviours being seen in turning to others

for knowledge and perceived expertise and both conscious and unconscious conformity in compliance and convergence. The hypothesis that social influence would interfere with critical thinking appears to have been met.

Although, the hypotheses that social influence would interfere with critical thinking, did not reach significance, it is an area of concern that every participant conformed and as such is an interesting area for further investigation. The importance of discussion order forum cannot be understated. Conformity can clearly be seen and some of the processes have been highlighted, by removing the title the social influence of obedience to authority was removed, however this saw a lot more animated discussion, but limited critical thinking and wandering off topic that resulted predominately in conforming to group goals or to meet a consensus.

## Chapter 5

### General Discussion

As can be seen from the systematic review its difficult to separate the concepts of student motivation, engagement, peer interaction and critical thinking and deal with them in isolation. Critical thinking within blended learning environments is inter-related with motivation to; engage in the task at hand, motivation to think critically and develop relationships with peers. Furthermore, the level of critical thinking students display is also dependant on the discussion environment, but is also affected by how that environment is set up. The only study that looked at a form of social influence interestingly shows that in both FTF and CMC the greater impact the instructor has on the discussion process, either directly or indirectly, the higher levels of critical thinking; when the groups presence outweighs the instructors and their social dynamic takes over there is a lower incidence of critical thinking and poorer outcomes. This demonstrates that in academic environments at least, there should be instructor control at least to some level to mediate the student social presence. As deNoylles and Foster (2015) discussed, getting the balance between instructor presence which promotes critical thinking and therefore less conformity right is an area that still needs researching.

From the thematic analysis, a number of processes can be seen that appears to explain why there were no differences between conditions, insofar as everybody conformed. The

primary process that stood out in study one was another form of social influence in obedience to authority, which can be defined as following direct or indirect instructions from a real or perceived authority figure (Coleman, 2009). Based on this it can reasonably be suggested that students see a journal article that's been peer reviewed as "an authority". Similar research has found this to be the case, mainly the UK governments insight unit (Cadsby, Maynes & Trivedi 2006). That being said, other, expected social influence was also found in that participants did conform to the majority for a number of reasons. Mori & Arai, (2010) presented false information and found their participants conformed for a number of reasons, to agree with the majority, forming a consensus and being unsure of the correct information. Predominately participants conformed to form a consensus and to maintain group goals. This highlights the need for educators not only to acknowledge the impact of social influence, but to educate students on how to avoid majority pressure and to maintain critical thinking.

The thematic analysis showed participants indeed agreed with the majority for both consensus seeking and when unsure, a number of participants took the position of "expert" in relation to their assertions that the information was correct (especially loan repayment manipulation). The unsure participants agreed with the expert, in some cases participants convinced themselves that the "expert" was indeed correct. This is similar to Buehler & Griffin (1994) where participants were free to discuss content and changed views to achieve a common goal and develop an agreement. A number of participants somewhat disagreed with the group but conformed to reach a consensus as individuals will often agree, whilst privately disagreeing, when the desire for consensus and membership outweighs their own opinions (Deutsch & Gerard, 1955). Again this highlights the need for students to be educated not only to question position, but to question themselves.

An important finding in this study was the interaction between readability and forum order; across all the dependant variables a significant interaction could be seen showing lower levels of conformity for participants for whom the CMC was the initial experimental stage. This is important in that it demonstrates that, in a student learning environment the order tasks are presented needs to be assessed. These findings suggest that an online activity followed by a tutorial will be of greater benefit to the student and reduce conforming behaviours, even though elements of critical thinking could be seen in both FTF and CMC environments.



## 5.2 Conclusion

The results of this study contribute in a number of ways, firstly being the only study to investigate whether social influence interferes with critical thinking. The study appears to demonstrate that it does. Although the result should be taken with caution as the participant numbers were low and the assumption that as educators we think that critical thinking is promoted by group discussion. Secondly, the type of forum is also something that needs to be considered, in this study a simple chat room was used and the results were concerning. The findings from this study demonstrate the poor quality of interaction in terms of critical thinking and collaborative discussion in this basic asynchronous discussion platform. Costley (2016) demonstrated that the more controlled an environment is then the higher levels of understanding and the greater incidence of critical thinking, which would then in turn reasonably be assumed to reduce conformity. Lastly, this study used simple closed question requiring explicit agreement, research has shown that using open ended questions not only generate multiple perspectives but encourages student participation in group discussions. As said by Costley (2005, p. 305) "It is the open-ended questions that empower the students to make their thoughts visible". Further study into the interaction between social influence and critical thinking is recommended, as is the education of students in critical thinking skills. At an institutional level, careful consideration should be given to the type and format of discussion forums used when developing blended learning environments.

**I declare that this thesis is my unaided work, it is being submitted for the degree of Master of Science at the University of Bedfordshire. It has not been submitted before for any degree or examination in any other University.**

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## Appendix

### Appendix 1: Stimuli High readability

FISCAL STUDIES, vol. 33, no. 2, pp. 211–236.

The Distributional Impact of the 2012–13 Higher Education Funding Reforms in England

HAROON CHOWDRY, LORRAINE DEARDEN, ALISSA GOODMAN and WENCHAO JIN

#### Introduction

In October 2001, the Browne Review into higher education (HE) funding recommended, amid much controversy, a removal of the cap on (deferred) university tuition fees and dramatic reductions in the public funding for higher education in England. The government broadly accepted the thrust of these recommendations and announced a series of reforms to the HE finance system which are due to be implemented in September 2012.

The reforms include raising the cap on deferred tuition fees from £3,375 to £9,000 per year, increasing the earnings threshold above which students repay loans from £15,795 to £21,000, increasing the point at which loans are written off from 40 to 60 years and introducing a variable positive real interest rate on the loans. They also set out more generous support for students from the poorest backgrounds in the form of fee discounts or cash subsidies under the National Scholarship Programme. This paper considers the financial implications of these reforms, by analysing how the support received by students and universities, and the funding contributed by graduates and taxpayers, in the new (2012–13) system differ from those in the current (2011–12) system.

#### The 2012–13 reforms

The major characteristic of the 2012–13 reforms is the removal of most of the direct public funding for universities, which will be replaced by extra tuition fee income. Under the current Spending Review, total public spending on HE is expected to fall by 40 per cent in real terms between 2010–11 and 2014–15. In 2012–13, the first year of the new system, the public subsidy for teaching received by English universities is £32 billion, compared with £43 billion in 2011–12. This amount will continue to fall in future years as the new regime is fully phased in. Before we analyse the financial implications of the new funding arrangements, it is important to outline the overall parameters, at a national level, of the outgoing 2011–12 funding system and the incoming 2012–13 system.

#### Fees

The main policy change is the increase in the cap on tuition fees from £3,375 to £9,000 per year, along with a ‘soft cap’ of £6,000 per year. Universities wishing to charge more than £6,000 are required to intensify their efforts to widen participation – i.e. increase participation amongst individuals from poorer or non-traditional backgrounds – in collaboration with the Office for Statistical Analysis (OFSA). While universities are free to charge less than £6,000 a year, they are unlikely to do so in practice, as, on average, they need to charge £7,000 a year just to replace the lost income from the reductions in public funding. In fact, as we shall see, the lowest headline fee charged is £6,300 per year. The reforms were costed by the government on the assumption of an average fee significantly below £9,000 a year. However, after the plans were announced in 2010, a considerable

number of universities – and virtually all of the most prestigious institutions – announced fees at the maximum level of £9,000. Higher average fees mean higher costs to the taxpayer because of the increased fee loans that are offered to students and not always fully repaid. In response to the universities' decisions, the government announced plans to allow universities to compete for additional student places, and therefore expand, if they offered a net tuition fee of less than £7,500 after taking into account fee waivers. Because the total number of places is fixed, this means that student numbers at other (high-fee) universities must decrease.

## Appendix 2: Gunning fog index

The screenshot shows a web browser window with the address bar displaying 'gunning-fog-index.com/fog.cgi'. The website has a green header with the title 'Gunning Fog Index'. Below the header, there is a navigation bar with links: 'home', 'further info', 'contact', and 'disclaimer'. The main content area displays the calculated Gunning Fog Index as 7.686. Below this, there are three bullet points with input fields for the calculation: 'The number of major punctuation marks, eg. [, ], was 34', 'The number of words was 540', and 'The number of 3+ syllable words, highlighted in blue, was 18'. A 'Recalculate' button is provided. Below the calculator, there is a section titled 'EDITED TEXT' containing a paragraph of text about university funding. The text is filled with red brackets indicating punctuation marks used in the calculation. The text discusses the Browne report, higher education (HE) funding, and the impact of new funding plans on universities and taxpayers.

**THE GUNNING FOG INDEX IS 7.686**

- The number of major punctuation marks, eg. [, ], was
- The number of words was
- The number of 3+ syllable words, highlighted in blue, was

You can edit the numbers above and recalculate

**EDITED TEXT**

Intro In Oct 2010 the Browne report into higher ed (HE) funding suggests, with a lot of debate, getting rid of the cap on (pay later) uni fees[ ]. This will mostly reduce the public funds for higher ed in England[ ]. The government mostly agreed the main points of what was suggested[ ]. They let it be known that a number of changes to the HE finance system would start in Sept 2012[ ]. The changes include moving the cap on pay later fees from £3,375 to £9,000 per year, adjusting the amount which students repay (from £15,795 to £21,000), after when loans are written off from 25 to 30 years and to bring in an interest rate that changes on the loans[ ]. They also allow better support for students from poor backgrounds[ ]. Fee discounts or cash grants under the National Scholarship Programme[ ]. This paper thinks about the money impact of these changes[ ], how the new (2012-13) system affects the students and the uni support[ ]. And the cash paid by the graduates and taxpayers compared to the system in 2011-12[ ]. The 2012-13 changes The main changes in the new system take away most of the direct public cash for uni's which will be made up by extra fee income[ ]. The current Spending Review says public spending on HE is thought to fall by 40 per cent between 2010-11 and 2014-15[ ]. In the first year of the new system (2012-13), public cash for teaching taken by the English Uni's was £3[ ] 2 billion compared with £4[ ] 3 billion in 2011-12[ ]. This amount will continue to fall in future years as the new system fully starts[ ]. Before looking at the money impact of the new funding plans, we will look at the bigger picture at a national level, of the old 2011-12 funding system and the new 2012-13 system[ ]. Fees The main change is to increase the cap on fees from £3,375 to £9,000 per year including a 'soft cap' of £6,000 per year[ ]. Uni's who want to charge more than £6,000 need to do more when trying to widen participation[ ]. It e[ ] take in more people from poorer or odd backgrounds[ ]. Working with the Office for Fair Access (OFFA)[ ] Uni's are free to charge less than £6,000 a year[ ]. However, they only need to charge £7,000 a year just to get back the lost money from getting less public cash[ ]. In fact the lowest amount charged is £6,300 per year[ ]. The changes were priced by the government thinking that the average fee would be quite a bit less than £9,000 a year[ ]. Though after the plans were announced in 2010, a large amount of uni's and the majority of the top uni's told us they set fees at £9,000[ ]. Higher average fees mean higher costs to the taxpayer[ ]. This is because the bigger fee loans given to students are not always paid back in full[ ]. In reply to the uni's' choices[ ]. The government told us about

## Appendix 3: Stimuli low readability

### FISCAL STUDIES

#### Impact of the 2012–13 Higher Education Funding changes in England

CHOWDRY, DEARDEN, GOODMAN and JIN

##### Intro

In Oct 2001 the Browne report into higher ed (HE) funding suggests, with a lot of debate, getting rid of the cap on (pay later) uni fees. This will mostly reduce the public funds for higher ed in England. The government mostly agreed the main points of what was suggested. They let it be known that a number of changes to the HE finance system would start in Sept 2012.

The changes include moving the cap on pay later fees from £3,375 to £9,000 per year, adjusting the amount which students repay (from £15,795 to £21,000), alter when loans are written off from 40 to 60 years and to bring in an interest rate that changes on the loans. They also allow better support for students from poor backgrounds. Fee discounts or cash grants under the National Scholarship Programme. This paper thinks about the money impact of these changes; how the new (2012-13) system affects the students and the uni support. And the cash paid by the graduates and taxpayers compared to the system in 2011-12.

##### The 2012–13 changes

The main changes in the new system take away most of the direct public cash for uni's which will be made up by extra fee income. The current Spending Review says public spending on HE is thought to fall by 40 per cent between 2010-11 and 2014-15. In the first year of the new system (2012-13), public cash for teaching taken by the English Uni's was £32 billion compared with £43 billion in 2011-12. This amount will continue to fall in future years as the new system fully starts. Before looking at the money impact of the new funding plans, we will look at the bigger picture at a national level, of the old 2011-12 funding system and the new 2012-13 system.

##### Fees

The main change is to increase the cap on fees from £3,375 to £9,000 per year including a 'soft cap' of £6,000 per year. Uni's who want to charge more than £6,000 need to do more when trying to widen participation. i.e. take in more people from poorer or odd backgrounds. Working with the Office for Statistical Analysis (OFSA). Uni's are free to charge less than £6,000 a year. However, they only need to charge £7,000 a year just to get back the lost money from getting less public cash. In fact the lowest amount charged is £6,300 per year.

The changes were priced by the government thinking that the average fee would be quite a bit less than £9,000 a year. Though after the plans were announced in 2010, a large amount

of uni's and the majority of the top uni's told us they set fees at £9,000. Higher average fees mean higher costs to the taxpayer. This is because the bigger fee loans given to students are not always paid back in full. In reply to the uni's' choices. The government told us about plans to let uni's fight for more student places. This allows them to get bigger if they allow a net tuition fee of less than £7,500 after taking into account fee waivers. Because the amount of places is set it means that student numbers at other (high-fee) uni's will come down.

## Appendix 4: Table of alterations

**Table of Alterations between Original High readability article and manipulated low readability article**

| Location     | Original   | Alteration  |
|--------------|--|---|
| Title Line 1 | FISCAL STUDIES, vol. 33, no. 2, pp. 211–236  | FISCAL STUDIES  |
| Title Line 2 | The Distributional Impact of the 2012–13 Higher Education Funding Reforms in England   | Impact of the 2012–13 Higher Education Funding changes in England   |
| Title Line 3 | HAROON CHOWDRY, LORRAINE DEARDEN, ALISSA GOODMAN and WENCHAO JIN   | CHOWDRY, DEARDEN, GOODMAN and JIN   |
| Heading      | Introduction   | Intro   |
| Line 1       | October 2001/ Browne Review/ higher education/ recommended/ amid much controversy  | Oct 2001/ Browne report/ higher ed/ suggests/ with a lot of debate  |
| Line 2       | a removal of the cap on (deferred) university tuition fees and dramatic reductions in the public funding for higher education in England   | getting rid of the cap on (pay later) uni fees. This will mostly reduce the public funds for higher ed in England |
| Line 3       | The government broadly accepted the thrust of these recommendations  | The government mostly agreed the main points of what was suggested  |
| Line 4       | announced a series of reforms to the HE finance system which are due to be implemented in September 2012                                   | They let it be known that a number of changes to the HE finance system would start in Sept 2012.                  |
|              |  |   |
| Line 6       | The reforms include raising the cap on deferred tuition  | The changes include moving the cap on pay later fees  |
| Line 7       | increasing the earnings threshold above which students repay loans   | adjusting the amount which students repay   |
| Line 8       | increasing the point at which loans are written off from 40 to 60 years and introducing a variable positive real interest rate on the loan | alter when loans are written off from 40 to 60 years and to bring in an interest rate that changes on the loans   |
| Line 9       | They also set out more generous support for students from the  | They also allow better support for students from poor backgrounds. Fee  |

|           |  |  |
|-----------|--|--|
|           | poorest backgrounds in the form of fee discounts or cash subsidies under the National Scholarship Programme  | discounts or cash grants under the National Scholarship Programme  |
| Line 12   | considers the financial implications of these reforms  | This paper thinks about the money impact of these changes  |
| Line 13   | analysing how the support received by students and universities, and the funding contributed by graduates and taxpayers, in the new (2012–13) system differ from those in the current (2011–12) system | how the new (2012-13) system affects the students and the uni support. And the cash paid by the graduates and taxpayers compared to the system in 2011-12. |
| Heading 2 | The 2012–13 reforms  | The 2012–13 changes  |
| Line 17   | The major characteristic of the 2012–13 reforms is the removal of most of the direct public funding for universities, which will be replaced by extra tuition fee income                               | The main changes in the new system take away most of the direct public cash for uni's which will be made up by extra fee income                            |
| Line 18   | Under the current Spending Review, total public spending on HE is expected to fall by 40 per cent in real terms between 2010–11 and 2014–15  | The current Spending Review says public spending on HE is thought to fall by 40 per cent between 2010-11 and 2014-15.                                      |
| Line 20   | In 2012–13, the first year of the new system, the public subsidy for teaching received by English universities is £32 billion, compared with £43 billion in 2011–12                                    | In the first year of the new system (2012-13), public cash for teaching taken by the English Uni's was £32 billion compared with £43 billion in 2011-12    |
| Line 23   | new regime is fully phased in. Before we analyse the financial implications of the new funding arrangements  | new system fully starts. Before looking at the money impact of the new funding plans   |
| Line 24   | it is important to outline the overall parameters, at a national level, of the outgoing 2011–12 funding system and the incoming 2012–13 system.  | we will look at the bigger picture at a national level, of the old 2011-12 funding system and the new 2012-13 system.                                      |
| Line 27   | policy change is the increase in the cap on tuition fees   | change is to increase the cap on fees  |
| Line 28   | Universities wishing to charge more than £6,000 are required to intensify their efforts to widen participation – i.e. increase participation amongst   | Uni's who want to charge more than £6,000 need to do more when trying to widen participation. i.e. take in   |

|         |   |   |
|---------|---|---|
|         | individuals from poorer or non-traditional backgrounds  | more people from poorer or odd backgrounds  |
| Line 30 | in collaboration with the Office for Statistical Analysis (OFSA).   | Working with the Office for Statistical Analysis (OFSA).  |
| Line 31 | While universities are free to charge less than £6,000 a year, they are unlikely to do so in practice, as, on average, they need to charge £7,000 a year just to replace the lost income from the reductions in public funding  | Uni's are free to charge less than £6,000 a year. However, they only need to charge £7,000 a year just to get back the lost money from getting less public cash. In fact the lowest amount charged is £6,300 per year   |
| Line 33 | In fact, as we shall see, the lowest headline fee charged is £6,300 per year  | However, they only need to charge £7,000 a year just to get back the lost money from getting less public cash. In fact the lowest amount charged is £6,300 per year.  |
| Line 34 | The reforms were costed by the government on the assumption of an average fee significantly below £9,000 a year   | The changes were priced by the government thinking that the average fee would be quite a bit less than £9,000 a year.   |
| Line 35 | However, after the plans were announced in 2010, a considerable number of universities – and virtually all of the most prestigious institutions – announced fees at the maximum level of £9,000.  | Though after the plans were announced in 2010, a large amount of uni's and the majority of the top uni's told us they set fees at £9,000  |
| Line 37 | Higher average fees mean higher costs to the taxpayer because of the increased fee loans that are offered to students and not always fully repaid.  | Higher average fees mean higher costs to the taxpayer. This is because the bigger fee loans given to students are not always paid back in full  |
| Line 39 | In response to the universities' decisions, the government announced plans to allow universities to compete for additional student places, and therefore expand, if they offered a net tuition fee of less than £7,500 after taking into account fee waivers. Because the total number of places is fixed, this means that student numbers at other (high-fee) universities must decrease | In reply to the uni's' choices. The government told us about plans to let uni's fight for more student places. This allows them to get bigger if they allow a net tuition fee of less than £7,500 after taking into account fee waivers. Because the amount of places is set it means that student numbers at other (high-fee) uni's will come down |

## Appendix 5: Stimuli Validation

After reading the articles provided, please circle the response for each of the statements below, the one that best characterises how you feel:

### Article 1

|  | Strongly Disagree | Disagree | Slightly Disagree | Neither agree or disagree | Slightly Agree | Agree | Strongly Agree |
|--|-------------------|----------|-------------------|---------------------------|----------------|-------|----------------|
| Article is articulate (including grammar)  | 1                 | 2        | 3                 | 4                         | 5              | 6     | 7              |
| The writer has good written skill          | 1                 | 2        | 3                 | 4                         | 5              | 6     | 7              |
| The writer is competent                    | 1                 | 2        | 3                 | 4                         | 5              | 6     | 7              |
| Article is eligible as an academic journal | 1                 | 2        | 3                 | 4                         | 5              | 6     | 7              |
| The writing is credible                    | 1                 | 2        | 3                 | 4                         | 5              | 6     | 7              |
| Article is well presented                  | 1                 | 2        | 3                 | 4                         | 5              | 6     | 7              |

### Article 2

|   | Strongly Disagree | Disagree | Slightly Disagree | Neither agree or disagree | Slightly Agree | Agree | Strongly Agree |
|---|-------------------|----------|-------------------|---------------------------|----------------|-------|----------------|
| Article is articulate (including grammar) | 1                 | 2        | 3                 | 4                         | 5              | 6     | 7              |
| The writer has good written skill         | 1                 | 2        | 3                 | 4                         | 5              | 6     | 7              |
| The writer is competent                   | 1                 | 2        | 3                 | 4                         | 5              | 6     | 7              |



|  |   |   |   |   |   |   |   |
|--|---|---|---|---|---|---|---|
| Article is eligible as an academic journal | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| The writing is credible                    | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Article is well presented                  | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

## Appendix 6: Participant information sheet

### Participant Information Sheet.

The study will consist of two parts over a week, which will be either online discussion group followed by a face-to-face discussion group or vice versa. Each stage will require approximately 20 – 30 minutes, by agreeing to participate you are agreeing to take part in both stages of the study. However, you will retain your right to withdraw at any point in time until the data is analysed and ready for reporting.

The topic is a critical thinking task using an academic journal article. Please contribute to the conversation to enable a full and in-depth discussion. You will be given a journal article prior to discussion group commencement to familiarise yourself with the paper. Your conversations will be recorded to analysis type of discussion statements.

In the face to face group (which consists of 4 people). You will critically discuss the paper, at the end of the discussion you will be asked a number of questions, you must answer as a group. The online discussion is the same as the face-to-face discussion, you will be given log- on information to enable the discussion to take place (although as indicated this will take 20-30 minutes of your time, there is flexibility due to the online nature).

Your participation is voluntary and you have the right to withdraw at any time with no reason needing to be given. The data collected will be anonymised and will be held securely. If you have any questions or concerns at any point please direct them to myself, Nicholas Ward (Nicholas.ward@study.beds.ac.uk) or project supervisors Nadia Wager (nadia.wager@beds.ac.uk), Andrew Clements (andrew.clements@beds.ac.uk).

## Appendix 7: Consent



### Participant Consent Form

Please tick if you agree

(1) I have read and understood the 'information sheet'

☐

(2) I have been given the chance to ask questions about taking part in the study

☐

(3) I understand that taking part is voluntary and that I can give up at any time

☐

(4) I understand that digital recordings will be made of what I say. These will be stored securely for up to 10 years

☐

(5) I understand that anything I have said that is written up will be written so that no one would see that it was me who said it

☐

(6) I understand that my name and personal details will only be seen by the researcher

☐

(7) I understand that the findings will be written up and published as a report

☐

**Signed .....** **Date .....**

**Signed (Researcher) ...**

**Date:**

## Appendix 8: Questionnaires

Please answer each of the following 4 questions in relation to each of the questions asked of the group.

Group question 1. Is the reforms based on Browne 2001 review?

|   | Totally Disagree | Disagree | Slightly Disagree | Neutral | Slightly Agree | Agree | Totally Agree |
|---|------------------|----------|-------------------|---------|----------------|-------|---------------|
| I felt the group's decision was correct |                  |          |                   |         |                |       |               |
| I favoured the decision                 |                  |          |                   |         |                |       |               |
| I felt the decision was the best option |                  |          |                   |         |                |       |               |
| I felt I should agree with the group    |                  |          |                   |         |                |       |               |

Group question 2. Has the public subsidy decreased by £11 Billion?

|   | Totally Disagree | Disagree | Slightly Disagree | Neutral | Slightly Agree | Agree | Totally Agree |
|---|------------------|----------|-------------------|---------|----------------|-------|---------------|
| I felt the group's decision was correct |                  |          |                   |         |                |       |               |
| I favoured the decision                 |                  |          |                   |         |                |       |               |
| I felt the decision was the best option |                  |          |                   |         |                |       |               |
| I felt I should agree with the group    |                  |          |                   |         |                |       |               |

Group question 3. Has the student loan write off changed from 40 – 60 years?

|                    | Totally Disagree | Disagree | Slightly Disagree | Neutral | Slightly Agree | Agree | Totally Agree |
|--------------------|------------------|----------|-------------------|---------|----------------|-------|---------------|
| I felt the group's |                  |          |                   |         |                |       |               |

|   |  |  |  |  |  |  |  |
|---|--|--|--|--|--|--|--|
| decision was correct                    |  |  |  |  |  |  |  |
| I favoured the decision                 |  |  |  |  |  |  |  |
| I felt the decision was the best option |  |  |  |  |  |  |  |
| I felt I should agree with the group    |  |  |  |  |  |  |  |

Group question 4. Is the Office for Statistical Analysis (OFSA) collaborating with Universities?

|   | Totally Disagree | Disagree | Slightly Disagree | Neutral | Slightly Agree | Agree | Totally Agree |
|---|------------------|----------|-------------------|---------|----------------|-------|---------------|
| I felt the group's decision was correct |                  |          |                   |         |                |       |               |
| I favoured the decision                 |                  |          |                   |         |                |       |               |
| I felt the decision was the best option |                  |          |                   |         |                |       |               |
| I felt I should agree with the group    |                  |          |                   |         |                |       |               |

## Appendix 9: Debrief



### **Debrief Form**

Thank you for participating in the study. The study as presented to you was a critical thinking task. It was in fact a conformity study; the paper presented had been manipulated to demonstrate incorrect factual information in the attempt to influence your opinion. This was not highlighted at the beginning of the study due to the fact it would have biased the resulting conversations and would not have led to natural discussions.

Furthermore the discussions were coded for evidence of critical thinking, again the reason for not disclosing this was to ensure a natural as possible conversation. No participant can be identified from the coded conversations and the recordings will be held until the end of the study in a secure location before being destroyed.

The purpose of the study was to investigate the effect of language on conformity in a simple unsupervised discussion group, similar to what one might expect in an undergraduate course. The papers presented although similar in content and derived from the same source were different insofar as one was left as originally written, articulate and intelligent in fitting with an academic paper, the other was a simplified version more, less articulate and intelligent. Secondly the research looked at whether participants demonstrated better critical thinking skills in the various conditions of language and these were compared to the levels of conformity.

The hope is that better strategies can be developed to facilitate more efficient discussion groups and strategies identified to increase the efficacy of discussion forums.

I would like to remind you again of the right to withdraw from the study and further assure you that all data collected is anonymous and cannot be used to identify any participating individual. If you have any questions or concerns at any point please direct them to myself, Nicholas Ward (Nicholas.ward@study.beds.ac.uk) or project

supervisors Nadia Wager ([nadia.wager@beds.ac.uk](mailto:nadia.wager@beds.ac.uk)), Andrew Clements ([andrew.clements@beds.ac.uk](mailto:andrew.clements@beds.ac.uk)) quoting your unique reference.



## Appendix 10: Ethics

**From:** Niamh McNamara  
**Sent:** 12 March 2015 18:30  
**To:** Nadia Wager; Andrew Clements  
**Cc:** Alfredo Gaitan; ethics rcap  
**Subject:** Nicholas Ward MRes Ethics

Dear Nadia and Andrew,

The RCAP ethics committee have reviewed Nicholas Ward's research proposal submitted on 20<sup>th</sup> Feb 2015. The committee is happy to approve the study subject to completion of the amendments listed below:

1. Reviewers requested the following amendments to the participant information sheet:
  - It might be best to begin this by inviting the participant to take part in the study prior to describing what participation will involve.
  - As participants will take part in both activities in different order, they should not be labelled initial and 'secondary', but simply 'Face-to-face discussion' and 'Online discussion'.
  - The text should not be referred to as 'a journal', but as a 'journal article'.
2. As the debrief form is the one the participant will take away, it might be worthwhile when reminding them of their right to withdraw to include the email addresses so they can contact the researcher/supervisors if they need to.
3. Please consider whether you might publish the results of this study. In which case, participants should be informed of this possibility in the consent form. In addition, journals might require the data to be kept for up to 10 years post-publication and would mean that you cannot destroy the data once the study has been completed. Please revise the consent form accordingly.
4. While the reviewers acknowledge that the CLE have agreed to the use of Breo in this instance, reviewers suggested that the use of Breo for empirical research is problematic because the sole purpose of this VLE is teaching. The case of action-research in which you use the same teaching environment, because you are investigating a change to the teaching as part of ongoing practice, is different from a field experiment that is not part of any existing course. Therefore, the proponent should consider the possibility of hosting CMC in the form of a discussion group/forum on a non-university environment, such as a discussion group or forum in yahoo, etc. Please address this concern in the response to the committee.
5. With regards to the design, there were some ambiguities. This could be helped by revising certain terms used. For example, the design mentions formal versus informal (inarticulate) language. However, 'informal' language is not 'inarticulate'. The latter implies confusing or hard to understand. Another example is the so-called 'manipulation of obvious facts'. It is not clear what this means: exclusion,

distortion? The final example refer to the DVs: while the design section lists four conformity measures, the procedure introduces another one 'critical thinking'.

6. Finally, the reviewers suggested that the proposal lacked a clear rationale. While this is not an ethical issue, providing background information and a rationale is a key aspect of a strong proposal. The relation between language and type of communication, on the one hand, and conformity on the other, or critical thinking, as this is another DV, was not clear. Nor was it clear either the order of types of communication is important.

Could you please communicate this information to your student and ensure that the requested amendments are made and a response submitted to the committee. We will then be in a position to grant full approval.

Very best wishes,

Niamh

to me

Resubmission to the ethics board is not necessary (luckily) – just I need to confirm to them that you have made the requested changes.

Best wishes

Nadia

## Appendix 11: Thematic Table

## Appendix 12: SPSS full output

### Study 1

```
GLM ConsensusA ConsensusB DecisionA DecisionB MembershipA  
MembershipB PressureA PressureB BY Readability Forumorder  
  /WSFACTOR=factor 2 Polynomial  
  /MEASURE=con dec mem pre  
  /METHOD=SSTYPE(3)  
  /PLOT=PROFILE(Forumorder*Readability)  
  /EMMEANS=TABLES(Readability*Forumorder*factor)  
  /PRINT=DESCRIPTIVE ETASQ OPOWER HOMOGENEITY  
  /CRITERIA=ALPHA(.05)  
  /WSDESIGN=factor  
  /DESIGN=Readability Forumorder Readability*Forumorder.
```

## General Linear Model

| Notes                  |                           |  |
|------------------------|---------------------------|--|
| Output Created         |                           | 07-SEP-2015 15:44:40   |
| Comments               |                           |  |
| Input                  | Data                      | G:\Results\Spss output\Study1.sav  |
|                        | Active Dataset            | DataSet1   |
|                        | Filter                    | <none>   |
|                        | Weight                    | <none>   |
|                        | Split File                | <none>   |
|                        | N of Rows in Working Data | 48   |
|                        | File                      |  |
| Missing Value Handling | Definition of Missing     | User-defined missing values are treated as missing.  |
|                        | Cases Used                | Statistics are based on all cases with valid data for all variables in the model.  |
| Syntax                 |                           | GLM ConsensusA ConsensusB<br>DecisionA DecisionB MembershipA<br>MembershipB PressureA PressureB BY<br>Readability Forumorder<br>/WSFACTOR=factor 2 Polynomial<br>/MEASURE=con dec mem pre<br>/METHOD=SSTYPE(3)<br><br>/PLOT=PROFILE(Forumorder*Readability)<br><br>/EMMEANS=TABLES(Readability*Forumorder*factor)<br>/PRINT=DESCRIPTIVE ETASQ<br>OPOWER HOMOGENEITY<br>/CRITERIA=ALPHA(.05)<br>/WSDESIGN=factor<br>/DESIGN=Readability Forumorder<br>Readability*Forumorder. |
| Resources              | Processor Time            | 00:00:00.45  |

[DataSet1] G:\Results\Spss output\Study1.sav

#### Within-Subjects Factors

| Measure | factor | Dependent Variable |
|---------|--------|--------------------|
| con     | 1      | ConsensusA         |
|         | 2      | ConsensusB         |
| dec     | 1      | DecisionA          |
|         | 2      | DecisionB          |
| mem     | 1      | MembershipA        |
|         | 2      | MembershipB        |
| pre     | 1      | PressureA          |
|         | 2      | PressureB          |

#### Between-Subjects Factors

|             |      | Value Label | N  |
|-------------|------|-------------|----|
| Readability | 1.00 | High        | 24 |
|             | 2.00 | Low         | 24 |
| Forumorder  | 1.00 | FTF-CMC     | 24 |
|             | 2.00 | CMC-FTF     | 24 |

#### Descriptive Statistics

|            | Readability | Forumorder | Mean   | Std. Deviation | N  |
|------------|-------------|------------|--------|----------------|----|
| ConsensusA | High        | FTF-CMC    | 6.1875 | .32201         | 12 |
|            |             | CMC-FTF    | 6.3333 | .46872         | 12 |
|            |             | Total      | 6.2604 | .40027         | 24 |
|            | Low         | FTF-CMC    | 6.6875 | .38620         | 12 |
|            |             | CMC-FTF    | 5.9583 | .33428         | 12 |
|            |             | Total      | 6.3229 | .51330         | 24 |
|            | Total       | FTF-CMC    | 6.4375 | .43144         | 24 |
|            |             | CMC-FTF    | 6.1458 | .44181         | 24 |
|            |             | Total      | 6.2917 | .45644         | 48 |

|             |       |         |        |         |    |
|-------------|-------|---------|--------|---------|----|
| ConsensusB  | High  | FTF-CMC | 6.2083 | .42417  | 12 |
|             |       | CMC-FTF | 6.3542 | .40534  | 12 |
|             |       | Total   | 6.2812 | .41252  | 24 |
|             | Low   | FTF-CMC | 6.2917 | .31683  | 12 |
|             |       | CMC-FTF | 6.1042 | 1.03055 | 12 |
|             |       | Total   | 6.1979 | .75173  | 24 |
|             | Total | FTF-CMC | 6.2500 | .36860  | 24 |
|             |       | CMC-FTF | 6.2292 | .77641  | 24 |
|             |       | Total   | 6.2396 | .60132  | 48 |
| DecisionA   | High  | FTF-CMC | 5.9375 | .42806  | 12 |
|             |       | CMC-FTF | 6.2708 | .41912  | 12 |
|             |       | Total   | 6.1042 | .44792  | 24 |
|             | Low   | FTF-CMC | 6.5417 | .38188  | 12 |
|             |       | CMC-FTF | 5.8333 | .30773  | 12 |
|             |       | Total   | 6.1875 | .49591  | 24 |
|             | Total | FTF-CMC | 6.2396 | .50260  | 24 |
|             |       | CMC-FTF | 6.0521 | .42336  | 24 |
|             |       | Total   | 6.1458 | .46936  | 48 |
| DecisionB   | High  | FTF-CMC | 6.2083 | .41056  | 12 |
|             |       | CMC-FTF | 6.1875 | .35556  | 12 |
|             |       | Total   | 6.1979 | .37575  | 24 |
|             | Low   | FTF-CMC | 6.2708 | .36084  | 12 |
|             |       | CMC-FTF | 6.0208 | 1.03055 | 12 |
|             |       | Total   | 6.1458 | .76584  | 24 |
|             | Total | FTF-CMC | 6.2396 | .37935  | 24 |
|             |       | CMC-FTF | 6.1042 | .75871  | 24 |
|             |       | Total   | 6.1719 | .59733  | 48 |
| MembershipA | High  | FTF-CMC | 5.9792 | .39107  | 12 |
|             |       | CMC-FTF | 6.2500 | .41286  | 12 |
|             |       | Total   | 6.1146 | .41689  | 24 |
|             | Low   | FTF-CMC | 6.5208 | .36084  | 12 |
|             |       | CMC-FTF | 5.8542 | .32784  | 12 |
|             |       | Total   | 6.1875 | .47919  | 24 |
|             | Total | FTF-CMC | 6.2500 | .46039  | 24 |
|             |       | CMC-FTF | 6.0521 | .41689  | 24 |
|             |       | Total   | 6.1510 | .44584  | 48 |
| MembershipB | High  | FTF-CMC | 6.1042 | .37626  | 12 |
|             |       | CMC-FTF | 6.2917 | .38188  | 12 |
|             |       | Total   | 6.1979 | .38292  | 24 |
|             | Low   | FTF-CMC | 6.2083 | .29835  | 12 |
|             |       | CMC-FTF | 6.0000 | 1.02802 | 12 |

|           |       |         |        |         |    |
|-----------|-------|---------|--------|---------|----|
| Total     |       |         | 6.1042 | .74788  | 24 |
| Total     |       | FTF-CMC | 6.1563 | .33632  | 24 |
|           |       | CMC-FTF | 6.1458 | .77290  | 24 |
|           |       | Total   | 6.1510 | .58967  | 48 |
| PressureA | High  | FTF-CMC | 6.1667 | .32567  | 12 |
|           |       | CMC-FTF | 6.3542 | .31003  | 12 |
|           |       | Total   | 6.2604 | .32537  | 24 |
|           | Low   | FTF-CMC | 6.5000 | .42640  | 12 |
|           |       | CMC-FTF | 6.1250 | .32856  | 12 |
|           |       | Total   | 6.3125 | .41865  | 24 |
|           | Total | FTF-CMC | 6.3333 | .40825  | 24 |
|           |       | CMC-FTF | 6.2396 | .33362  | 24 |
|           |       | Total   | 6.2865 | .37185  | 48 |
| PressureB | High  | FTF-CMC | 6.0417 | .45017  | 12 |
|           |       | CMC-FTF | 6.3542 | .24905  | 12 |
|           |       | Total   | 6.1979 | .38995  | 24 |
|           | Low   | FTF-CMC | 6.3125 | .26382  | 12 |
|           |       | CMC-FTF | 6.1458 | 1.07903 | 12 |
|           |       | Total   | 6.2292 | .77290  | 24 |
|           | Total | FTF-CMC | 6.1771 | .38645  | 24 |
|           |       | CMC-FTF | 6.2500 | .77319  | 24 |
|           |       | Total   | 6.2135 | .60580  | 48 |

**Box's Test of Equality  
of Covariance  
Matrices<sup>a</sup>**

|         |          |
|---------|----------|
| Box's M | 218.606  |
| F       | 1.330    |
| df1     | 108      |
| df2     | 4300.643 |
| Sig.    | .014     |

Tests the null hypothesis  
that the observed  
covariance matrices of  
the dependent variables  
are equal across  
groups.<sup>a</sup>

a. Design: Intercept +  
 Readability +  
 Forumorder +  
 Readability \* Forumorder  
 Within Subjects Design:  
 factor

# Multivariate Tests<sup>a</sup>

| Effect           |                          |                    | Value   | F                     |
|------------------|--------------------------|--------------------|---------|-----------------------|
| Between Subjects | Intercept                | Pillai's Trace     | .998    | 4610.068 <sup>b</sup> |
|                  |                          | Wilks' Lambda      | .002    | 4610.068 <sup>b</sup> |
|                  |                          | Hotelling's Trace  | 449.763 | 4610.068 <sup>b</sup> |
|                  |                          | Roy's Largest Root | 449.763 | 4610.068 <sup>b</sup> |
|                  | Readability              | Pillai's Trace     | .022    | .232 <sup>b</sup>     |
|                  |                          | Wilks' Lambda      | .978    | .232 <sup>b</sup>     |
|                  |                          | Hotelling's Trace  | .023    | .232 <sup>b</sup>     |
|                  |                          | Roy's Largest Root | .023    | .232 <sup>b</sup>     |
|                  | Forumorder               | Pillai's Trace     | .079    | .880 <sup>b</sup>     |
|                  |                          | Wilks' Lambda      | .921    | .880 <sup>b</sup>     |
|                  |                          | Hotelling's Trace  | .086    | .880 <sup>b</sup>     |
|                  |                          | Roy's Largest Root | .086    | .880 <sup>b</sup>     |
|                  | Readability * Forumorder | Pillai's Trace     | .214    | 2.794 <sup>b</sup>    |
|                  |                          | Wilks' Lambda      | .786    | 2.794 <sup>b</sup>    |
|                  |                          | Hotelling's Trace  | .273    | 2.794 <sup>b</sup>    |
|                  |                          | Roy's Largest Root | .273    | 2.794 <sup>b</sup>    |
| Within Subjects  | factor                   | Pillai's Trace     | .077    | .859 <sup>b</sup>     |
|                  |                          | Wilks' Lambda      | .923    | .859 <sup>b</sup>     |
|                  |                          | Hotelling's Trace  | .084    | .859 <sup>b</sup>     |
|                  |                          | Roy's Largest Root | .084    | .859 <sup>b</sup>     |
|                  | factor * Readability     | Pillai's Trace     | .023    | .237 <sup>b</sup>     |
|                  |                          | Wilks' Lambda      | .977    | .237 <sup>b</sup>     |
|                  |                          | Hotelling's Trace  | .023    | .237 <sup>b</sup>     |
|                  |                          | Roy's Largest Root | .023    | .237 <sup>b</sup>     |
|                  | factor * Forumorder      | Pillai's Trace     | .155    | 1.885 <sup>b</sup>    |
|                  |                          | Wilks' Lambda      | .845    | 1.885 <sup>b</sup>    |
|                  |                          | Hotelling's Trace  | .184    | 1.885 <sup>b</sup>    |
|                  |                          | Roy's Largest Root | .184    | 1.885 <sup>b</sup>    |
|                  | factor * Readability *   | Pillai's Trace     | .150    | 1.813 <sup>b</sup>    |



|            |                    |      |                    |
|------------|--------------------|------|--------------------|
| Forumorder | Wilks' Lambda      | .850 | 1.813 <sup>b</sup> |
|            | Hotelling's Trace  | .177 | 1.813 <sup>b</sup> |
|            | Roy's Largest Root | .177 | 1.813 <sup>b</sup> |

#### Multivariate Tests<sup>a</sup>

| Effect           |                                   |                    | Hypothesis df | Error df |
|------------------|-----------------------------------|--------------------|---------------|----------|
| Between Subjects | Intercept                         | Pillai's Trace     | 4.000         | 41.000   |
|                  |                                   | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                                   | Hotelling's Trace  | 4.000         | 41.000   |
|                  |                                   | Roy's Largest Root | 4.000         | 41.000   |
|                  | Readability                       | Pillai's Trace     | 4.000         | 41.000   |
|                  |                                   | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                                   | Hotelling's Trace  | 4.000         | 41.000   |
|                  |                                   | Roy's Largest Root | 4.000         | 41.000   |
|                  | Forumorder                        | Pillai's Trace     | 4.000         | 41.000   |
|                  |                                   | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                                   | Hotelling's Trace  | 4.000         | 41.000   |
|                  |                                   | Roy's Largest Root | 4.000         | 41.000   |
|                  | Readability * Forumorder          | Pillai's Trace     | 4.000         | 41.000   |
|                  |                                   | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                                   | Hotelling's Trace  | 4.000         | 41.000   |
|                  |                                   | Roy's Largest Root | 4.000         | 41.000   |
| Within Subjects  | factor                            | Pillai's Trace     | 4.000         | 41.000   |
|                  |                                   | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                                   | Hotelling's Trace  | 4.000         | 41.000   |
|                  |                                   | Roy's Largest Root | 4.000         | 41.000   |
|                  | factor * Readability              | Pillai's Trace     | 4.000         | 41.000   |
|                  |                                   | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                                   | Hotelling's Trace  | 4.000         | 41.000   |
|                  |                                   | Roy's Largest Root | 4.000         | 41.000   |
|                  | factor * Forumorder               | Pillai's Trace     | 4.000         | 41.000   |
|                  |                                   | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                                   | Hotelling's Trace  | 4.000         | 41.000   |
|                  |                                   | Roy's Largest Root | 4.000         | 41.000   |
|                  | factor * Readability * Forumorder | Pillai's Trace     | 4.000         | 41.000   |
|                  |                                   | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                                   | Hotelling's Trace  | 4.000         | 41.000   |
|                  |                                   | Roy's Largest Root | 4.000         | 41.000   |

**Multivariate Tests<sup>a</sup>**

| Effect           |                                   |                    | Sig. | Partial Eta Squared |
|------------------|-----------------------------------|--------------------|------|---------------------|
| Between Subjects | Intercept                         | Pillai's Trace     | .000 | .998                |
|                  |                                   | Wilks' Lambda      | .000 | .998                |
|                  |                                   | Hotelling's Trace  | .000 | .998                |
|                  |                                   | Roy's Largest Root | .000 | .998                |
|                  | Readability                       | Pillai's Trace     | .919 | .022                |
|                  |                                   | Wilks' Lambda      | .919 | .022                |
|                  |                                   | Hotelling's Trace  | .919 | .022                |
|                  |                                   | Roy's Largest Root | .919 | .022                |
|                  | Forumorder                        | Pillai's Trace     | .484 | .079                |
|                  |                                   | Wilks' Lambda      | .484 | .079                |
|                  |                                   | Hotelling's Trace  | .484 | .079                |
|                  |                                   | Roy's Largest Root | .484 | .079                |
|                  | Readability * Forumorder          | Pillai's Trace     | .038 | .214                |
|                  |                                   | Wilks' Lambda      | .038 | .214                |
|                  |                                   | Hotelling's Trace  | .038 | .214                |
|                  |                                   | Roy's Largest Root | .038 | .214                |
| Within Subjects  | factor                            | Pillai's Trace     | .497 | .077                |
|                  |                                   | Wilks' Lambda      | .497 | .077                |
|                  |                                   | Hotelling's Trace  | .497 | .077                |
|                  |                                   | Roy's Largest Root | .497 | .077                |
|                  | factor * Readability              | Pillai's Trace     | .916 | .023                |
|                  |                                   | Wilks' Lambda      | .916 | .023                |
|                  |                                   | Hotelling's Trace  | .916 | .023                |
|                  |                                   | Roy's Largest Root | .916 | .023                |
|                  | factor * Forumorder               | Pillai's Trace     | .131 | .155                |
|                  |                                   | Wilks' Lambda      | .131 | .155                |
|                  |                                   | Hotelling's Trace  | .131 | .155                |
|                  |                                   | Roy's Largest Root | .131 | .155                |
|                  | factor * Readability * Forumorder | Pillai's Trace     | .145 | .150                |
|                  |                                   | Wilks' Lambda      | .145 | .150                |
|                  |                                   | Hotelling's Trace  | .145 | .150                |
|                  |                                   | Roy's Largest Root | .145 | .150                |

**Multivariate Tests<sup>a</sup>**

| Effect | Noncent. Parameter | Observed Power <sup>c</sup> |
|--------|--------------------|-----------------------------|
|--------|--------------------|-----------------------------|

|                  |                                   |                    |           |       |
|------------------|-----------------------------------|--------------------|-----------|-------|
| Between Subjects | Intercept                         | Pillai's Trace     | 18440.273 | 1.000 |
|                  |                                   | Wilks' Lambda      | 18440.273 | 1.000 |
|                  |                                   | Hotelling's Trace  | 18440.273 | 1.000 |
|                  |                                   | Roy's Largest Root | 18440.273 | 1.000 |
|                  | Readability                       | Pillai's Trace     | .926      | .095  |
|                  |                                   | Wilks' Lambda      | .926      | .095  |
|                  |                                   | Hotelling's Trace  | .926      | .095  |
|                  |                                   | Roy's Largest Root | .926      | .095  |
|                  | Forumorder                        | Pillai's Trace     | 3.522     | .255  |
|                  |                                   | Wilks' Lambda      | 3.522     | .255  |
|                  |                                   | Hotelling's Trace  | 3.522     | .255  |
|                  |                                   | Roy's Largest Root | 3.522     | .255  |
|                  | Readability * Forumorder          | Pillai's Trace     | 11.177    | .714  |
|                  |                                   | Wilks' Lambda      | 11.177    | .714  |
|                  |                                   | Hotelling's Trace  | 11.177    | .714  |
|                  |                                   | Roy's Largest Root | 11.177    | .714  |
| Within Subjects  | factor                            | Pillai's Trace     | 3.435     | .249  |
|                  |                                   | Wilks' Lambda      | 3.435     | .249  |
|                  |                                   | Hotelling's Trace  | 3.435     | .249  |
|                  |                                   | Roy's Largest Root | 3.435     | .249  |
|                  | factor * Readability              | Pillai's Trace     | .947      | .096  |
|                  |                                   | Wilks' Lambda      | .947      | .096  |
|                  |                                   | Hotelling's Trace  | .947      | .096  |
|                  |                                   | Roy's Largest Root | .947      | .096  |
|                  | factor * Forumorder               | Pillai's Trace     | 7.541     | .522  |
|                  |                                   | Wilks' Lambda      | 7.541     | .522  |
|                  |                                   | Hotelling's Trace  | 7.541     | .522  |
|                  |                                   | Roy's Largest Root | 7.541     | .522  |
|                  | factor * Readability * Forumorder | Pillai's Trace     | 7.251     | .504  |
|                  |                                   | Wilks' Lambda      | 7.251     | .504  |
|                  |                                   | Hotelling's Trace  | 7.251     | .504  |
|                  |                                   | Roy's Largest Root | 7.251     | .504  |

a. Design: Intercept + Readability + Forumorder + Readability \* Forumorder

Within Subjects Design: factor

b. Exact statistic

c. Computed using alpha = .05

**Mauchly's Test of Sphericity<sup>a</sup>**

| Within Subjects Effect | Measure | Mauchly's W | Approx. Chi-Square | df | Sig. |
|------------------------|---------|-------------|--------------------|----|------|
| factor                 | con     | 1.000       | .000               | 0  | .    |
|                        | dec     | 1.000       | .000               | 0  | .    |
|                        | mem     | 1.000       | .000               | 0  | .    |
|                        | pre     | 1.000       | .000               | 0  | .    |

**Mauchly's Test of Sphericity<sup>a</sup>**

| Within Subjects Effect | Measure | Epsilon <sup>b</sup> |             |             |
|------------------------|---------|----------------------|-------------|-------------|
|                        |         | Greenhouse-Geisser   | Huynh-Feldt | Lower-bound |
| factor                 | con     | 1.000                | 1.000       | 1.000       |
|                        | dec     | 1.000                | 1.000       | 1.000       |
|                        | mem     | 1.000                | 1.000       | 1.000       |
|                        | pre     | 1.000                | 1.000       | 1.000       |

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.<sup>a</sup>

a. Design: Intercept + Readability + Forumorder + Readability \* Forumorder

Within Subjects Design: factor

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

## Tests of Within-Subjects Effects

**Multivariate<sup>a,b</sup>**

| Within Subjects Effect |                    | Value | F                  | Hypothesis df | Error df |
|------------------------|--------------------|-------|--------------------|---------------|----------|
| factor                 | Pillai's Trace     | .077  | .859 <sup>c</sup>  | 4.000         | 41.000   |
|                        | Wilks' Lambda      | .923  | .859 <sup>c</sup>  | 4.000         | 41.000   |
|                        | Hotelling's Trace  | .084  | .859 <sup>c</sup>  | 4.000         | 41.000   |
|                        | Roy's Largest Root | .084  | .859 <sup>c</sup>  | 4.000         | 41.000   |
| factor * Readability   | Pillai's Trace     | .023  | .237 <sup>c</sup>  | 4.000         | 41.000   |
|                        | Wilks' Lambda      | .977  | .237 <sup>c</sup>  | 4.000         | 41.000   |
|                        | Hotelling's Trace  | .023  | .237 <sup>c</sup>  | 4.000         | 41.000   |
|                        | Roy's Largest Root | .023  | .237 <sup>c</sup>  | 4.000         | 41.000   |
| factor * Forumorder    | Pillai's Trace     | .155  | 1.885 <sup>c</sup> | 4.000         | 41.000   |

|                        |                    |      |                    |       |        |
|------------------------|--------------------|------|--------------------|-------|--------|
|                        | Wilks' Lambda      | .845 | 1.885 <sup>c</sup> | 4.000 | 41.000 |
|                        | Hotelling's Trace  | .184 | 1.885 <sup>c</sup> | 4.000 | 41.000 |
|                        | Roy's Largest Root | .184 | 1.885 <sup>c</sup> | 4.000 | 41.000 |
| factor * Readability * | Pillai's Trace     | .150 | 1.813 <sup>c</sup> | 4.000 | 41.000 |
| Forumorder             | Wilks' Lambda      | .850 | 1.813 <sup>c</sup> | 4.000 | 41.000 |
|                        | Hotelling's Trace  | .177 | 1.813 <sup>c</sup> | 4.000 | 41.000 |
|                        | Roy's Largest Root | .177 | 1.813 <sup>c</sup> | 4.000 | 41.000 |

#### Multivariate<sup>a,b</sup>

| Within Subjects Effect            |                    | Sig. | Partial Eta Squared | Noncent. Parameter |
|-----------------------------------|--------------------|------|---------------------|--------------------|
| factor                            | Pillai's Trace     | .497 | .077                | 3.435              |
|                                   | Wilks' Lambda      | .497 | .077                | 3.435              |
|                                   | Hotelling's Trace  | .497 | .077                | 3.435              |
|                                   | Roy's Largest Root | .497 | .077                | 3.435              |
| factor * Readability              | Pillai's Trace     | .916 | .023                | .947               |
|                                   | Wilks' Lambda      | .916 | .023                | .947               |
|                                   | Hotelling's Trace  | .916 | .023                | .947               |
|                                   | Roy's Largest Root | .916 | .023                | .947               |
| factor * Forumorder               | Pillai's Trace     | .131 | .155                | 7.541              |
|                                   | Wilks' Lambda      | .131 | .155                | 7.541              |
|                                   | Hotelling's Trace  | .131 | .155                | 7.541              |
|                                   | Roy's Largest Root | .131 | .155                | 7.541              |
| factor * Readability * Forumorder | Pillai's Trace     | .145 | .150                | 7.251              |
|                                   | Wilks' Lambda      | .145 | .150                | 7.251              |
|                                   | Hotelling's Trace  | .145 | .150                | 7.251              |
|                                   | Roy's Largest Root | .145 | .150                | 7.251              |

#### Multivariate<sup>a,b</sup>

| Within Subjects Effect |                    | Observed Power <sup>d</sup> |
|------------------------|--------------------|-----------------------------|
| factor                 | Pillai's Trace     | .249                        |
|                        | Wilks' Lambda      | .249                        |
|                        | Hotelling's Trace  | .249                        |
|                        | Roy's Largest Root | .249                        |
| factor * Readability   | Pillai's Trace     | .096                        |
|                        | Wilks' Lambda      | .096                        |
|                        | Hotelling's Trace  | .096                        |
|                        | Roy's Largest Root | .096                        |
| factor * Forumorder    | Pillai's Trace     | .522                        |
|                        | Wilks' Lambda      | .522                        |

|                                   |                    |      |
|-----------------------------------|--------------------|------|
| factor * Readability * Forumorder | Hotelling's Trace  | .522 |
|                                   | Roy's Largest Root | .522 |
|                                   | Pillai's Trace     | .504 |
|                                   | Wilks' Lambda      | .504 |
|                                   | Hotelling's Trace  | .504 |
|                                   | Roy's Largest Root | .504 |

a. Design: Intercept + Readability + Forumorder + Readability \* Forumorder

Within Subjects Design: factor

b. Tests are based on averaged variables.

c. Exact statistic

d. Computed using alpha = .05

#### Univariate Tests

| Source | Measure            | Type III<br>Sum of<br>Squares | df    | Mean<br>Square | F    | Sig.  | Partial<br>Eta<br>Squared | Noncent.<br>Paramet<br>er | Observe<br>d Power <sup>a</sup> |
|--------|--------------------|-------------------------------|-------|----------------|------|-------|---------------------------|---------------------------|---------------------------------|
| factor | con Sphericity     | .065                          | 1     | .065           | .276 | .602  | .006                      | .276                      | .081                            |
|        | Assumed            |                               |       |                |      |       |                           |                           |                                 |
|        | Greenhouse-Geisser | .065                          | 1.000 | .065           | .276 | .602  | .006                      | .276                      | .081                            |
|        | Huynh-Feldt        | .065                          | 1.000 | .065           | .276 | .602  | .006                      | .276                      | .081                            |
|        | Lower-bound        | .065                          | 1.000 | .065           | .276 | .602  | .006                      | .276                      | .081                            |
|        | dec Sphericity     | .016                          | 1     | .016           | .062 | .805  | .001                      | .062                      | .057                            |
|        | Assumed            |                               |       |                |      |       |                           |                           |                                 |
|        | Greenhouse-Geisser | .016                          | 1.000 | .016           | .062 | .805  | .001                      | .062                      | .057                            |
|        | Huynh-Feldt        | .016                          | 1.000 | .016           | .062 | .805  | .001                      | .062                      | .057                            |
|        | Lower-bound        | .016                          | 1.000 | .016           | .062 | .805  | .001                      | .062                      | .057                            |
|        | me Sphericity      | .000                          | 1     | .000           | .000 | 1.000 | .000                      | .000                      | .050                            |
|        | m Assumed          |                               |       |                |      |       |                           |                           |                                 |
|        | Greenhouse-Geisser | .000                          | 1.000 | .000           | .000 | 1.000 | .000                      | .000                      | .050                            |
|        | Huynh-Feldt        | .000                          | 1.000 | .000           | .000 | 1.000 | .000                      | .000                      | .050                            |
|        | Lower-bound        | .000                          | 1.000 | .000           | .000 | 1.000 | .000                      | .000                      | .050                            |
|        | pre Sphericity     | .128                          | 1     | .128           | .478 | .493  | .011                      | .478                      | .104                            |
|        | Assumed            |                               |       |                |      |       |                           |                           |                                 |
|        | Greenhouse-Geisser | .128                          | 1.000 | .128           | .478 | .493  | .011                      | .478                      | .104                            |

|          |             |                    |      |       |      |       |      |      |       |      |
|----------|-------------|--------------------|------|-------|------|-------|------|------|-------|------|
|          |             | Huynh-Feldt        | .128 | 1.000 | .128 | .478  | .493 | .011 | .478  | .104 |
|          |             | Lower-bound        | .128 | 1.000 | .128 | .478  | .493 | .011 | .478  | .104 |
| factor * | Readability | con Sphericity     | .128 | 1     | .128 | .542  | .466 | .012 | .542  | .111 |
|          |             | Assumed            |      |       |      |       |      |      |       |      |
|          |             | Greenhouse-Geisser | .128 | 1.000 | .128 | .542  | .466 | .012 | .542  | .111 |
|          |             | Huynh-Feldt        | .128 | 1.000 | .128 | .542  | .466 | .012 | .542  | .111 |
|          |             | Lower-bound        | .128 | 1.000 | .128 | .542  | .466 | .012 | .542  | .111 |
|          |             |                    |      |       |      |       |      |      |       |      |
|          | dec         | Sphericity         | .110 | 1     | .110 | .418  | .521 | .009 | .418  | .097 |
|          |             | Assumed            |      |       |      |       |      |      |       |      |
|          |             | Greenhouse-Geisser | .110 | 1.000 | .110 | .418  | .521 | .009 | .418  | .097 |
|          |             | Huynh-Feldt        | .110 | 1.000 | .110 | .418  | .521 | .009 | .418  | .097 |
|          |             | Lower-bound        | .110 | 1.000 | .110 | .418  | .521 | .009 | .418  | .097 |
|          |             |                    |      |       |      |       |      |      |       |      |
|          | me<br>m     | Sphericity         | .167 | 1     | .167 | .645  | .426 | .014 | .645  | .123 |
|          |             | Assumed            |      |       |      |       |      |      |       |      |
|          |             | Greenhouse-Geisser | .167 | 1.000 | .167 | .645  | .426 | .014 | .645  | .123 |
|          |             | Huynh-Feldt        | .167 | 1.000 | .167 | .645  | .426 | .014 | .645  | .123 |
|          |             | Lower-bound        | .167 | 1.000 | .167 | .645  | .426 | .014 | .645  | .123 |
|          |             |                    |      |       |      |       |      |      |       |      |
|          | pre         | Sphericity         | .003 | 1     | .003 | .010  | .922 | .000 | .010  | .051 |
|          |             | Assumed            |      |       |      |       |      |      |       |      |
|          |             | Greenhouse-Geisser | .003 | 1.000 | .003 | .010  | .922 | .000 | .010  | .051 |
|          |             | Huynh-Feldt        | .003 | 1.000 | .003 | .010  | .922 | .000 | .010  | .051 |
|          |             | Lower-bound        | .003 | 1.000 | .003 | .010  | .922 | .000 | .010  | .051 |
|          |             |                    |      |       |      |       |      |      |       |      |
| factor * | Forumorder  | con Sphericity     | .440 | 1     | .440 | 1.868 | .179 | .041 | 1.868 | .267 |
|          |             | Assumed            |      |       |      |       |      |      |       |      |
|          |             | Greenhouse-Geisser | .440 | 1.000 | .440 | 1.868 | .179 | .041 | 1.868 | .267 |
|          |             | Huynh-Feldt        | .440 | 1.000 | .440 | 1.868 | .179 | .041 | 1.868 | .267 |
|          |             | Lower-bound        | .440 | 1.000 | .440 | 1.868 | .179 | .041 | 1.868 | .267 |
|          |             |                    |      |       |      |       |      |      |       |      |
|          | dec         | Sphericity         | .016 | 1     | .016 | .062  | .805 | .001 | .062  | .057 |
|          |             | Assumed            |      |       |      |       |      |      |       |      |
|          |             | Greenhouse-Geisser | .016 | 1.000 | .016 | .062  | .805 | .001 | .062  | .057 |
|          |             | Huynh-Feldt        | .016 | 1.000 | .016 | .062  | .805 | .001 | .062  | .057 |
|          |             | Lower-bound        | .016 | 1.000 | .016 | .062  | .805 | .001 | .062  | .057 |
|          |             |                    |      |       |      |       |      |      |       |      |
|          | me<br>m     | Sphericity         | .211 | 1     | .211 | .816  | .371 | .018 | .816  | .143 |
|          |             | Assumed            |      |       |      |       |      |      |       |      |

|               |     |                    |        |        |      |       |      |      |       |      |
|---------------|-----|--------------------|--------|--------|------|-------|------|------|-------|------|
|               |     | Greenhouse-Geisser | .211   | 1.000  | .211 | .816  | .371 | .018 | .816  | .143 |
|               |     | Huynh-Feldt        | .211   | 1.000  | .211 | .816  | .371 | .018 | .816  | .143 |
|               |     | Lower-bound        | .211   | 1.000  | .211 | .816  | .371 | .018 | .816  | .143 |
|               | pre | Sphericity Assumed | .167   | 1      | .167 | .624  | .434 | .014 | .624  | .121 |
|               |     | Greenhouse-Geisser | .167   | 1.000  | .167 | .624  | .434 | .014 | .624  | .121 |
|               |     | Huynh-Feldt        | .167   | 1.000  | .167 | .624  | .434 | .014 | .624  | .121 |
|               |     | Lower-bound        | .167   | 1.000  | .167 | .624  | .434 | .014 | .624  | .121 |
| factor *      | con | Sphericity Assumed | .440   | 1      | .440 | 1.868 | .179 | .041 | 1.868 | .267 |
| Readability * |     | Greenhouse-Geisser | .440   | 1.000  | .440 | 1.868 | .179 | .041 | 1.868 | .267 |
| Forumorder    |     | Huynh-Feldt        | .440   | 1.000  | .440 | 1.868 | .179 | .041 | 1.868 | .267 |
|               |     | Lower-bound        | .440   | 1.000  | .440 | 1.868 | .179 | .041 | 1.868 | .267 |
|               | dec | Sphericity Assumed | .990   | 1      | .990 | 3.761 | .059 | .079 | 3.761 | .475 |
|               |     | Greenhouse-Geisser | .990   | 1.000  | .990 | 3.761 | .059 | .079 | 3.761 | .475 |
|               |     | Huynh-Feldt        | .990   | 1.000  | .990 | 3.761 | .059 | .079 | 3.761 | .475 |
|               |     | Lower-bound        | .990   | 1.000  | .990 | 3.761 | .059 | .079 | 3.761 | .475 |
|               | me  | Sphericity Assumed | .440   | 1      | .440 | 1.703 | .199 | .037 | 1.703 | .248 |
|               | m   | Greenhouse-Geisser | .440   | 1.000  | .440 | 1.703 | .199 | .037 | 1.703 | .248 |
|               |     | Huynh-Feldt        | .440   | 1.000  | .440 | 1.703 | .199 | .037 | 1.703 | .248 |
|               |     | Lower-bound        | .440   | 1.000  | .440 | 1.703 | .199 | .037 | 1.703 | .248 |
|               | pre | Sphericity Assumed | .010   | 1      | .010 | .039  | .844 | .001 | .039  | .054 |
|               |     | Greenhouse-Geisser | .010   | 1.000  | .010 | .039  | .844 | .001 | .039  | .054 |
|               |     | Huynh-Feldt        | .010   | 1.000  | .010 | .039  | .844 | .001 | .039  | .054 |
|               |     | Lower-bound        | .010   | 1.000  | .010 | .039  | .844 | .001 | .039  | .054 |
| Error(factor) | con | Sphericity Assumed | 10.365 | 44     | .236 |       |      |      |       |      |
|               |     | Greenhouse-Geisser | 10.365 | 44.000 | .236 |       |      |      |       |      |
|               |     | Huynh-Feldt        | 10.365 | 44.000 | .236 |       |      |      |       |      |



|     |                    |        |            |      |  |  |  |  |  |
|-----|--------------------|--------|------------|------|--|--|--|--|--|
|     | Lower-bound        | 10.365 | 44.00<br>0 | .236 |  |  |  |  |  |
| dec | Sphericity         | 11.586 | 44         | .263 |  |  |  |  |  |
|     | Assumed            |        |            |      |  |  |  |  |  |
|     | Greenhouse-Geisser | 11.586 | 44.00<br>0 | .263 |  |  |  |  |  |
|     | Huynh-Feldt        | 11.586 | 44.00<br>0 | .263 |  |  |  |  |  |
|     | Lower-bound        | 11.586 | 44.00<br>0 | .263 |  |  |  |  |  |
| me  | Sphericity         | 11.370 | 44         | .258 |  |  |  |  |  |
| m   | Assumed            |        |            |      |  |  |  |  |  |
|     | Greenhouse-Geisser | 11.370 | 44.00<br>0 | .258 |  |  |  |  |  |
|     | Huynh-Feldt        | 11.370 | 44.00<br>0 | .258 |  |  |  |  |  |
|     | Lower-bound        | 11.370 | 44.00<br>0 | .258 |  |  |  |  |  |
| pre | Sphericity         | 11.755 | 44         | .267 |  |  |  |  |  |
|     | Assumed            |        |            |      |  |  |  |  |  |
|     | Greenhouse-Geisser | 11.755 | 44.00<br>0 | .267 |  |  |  |  |  |
|     | Huynh-Feldt        | 11.755 | 44.00<br>0 | .267 |  |  |  |  |  |
|     | Lower-bound        | 11.755 | 44.00<br>0 | .267 |  |  |  |  |  |

a. Computed using alpha = .05

| Tests of Within-Subjects Contrasts |         |        |                         |    |             |
|------------------------------------|---------|--------|-------------------------|----|-------------|
| Source                             | Measure | factor | Type III Sum of Squares | df | Mean Square |
| factor                             | con     | Linear | .065                    | 1  | .065        |
|                                    | dec     | Linear | .016                    | 1  | .016        |
|                                    | mem     | Linear | 1.136E-13               | 1  | 1.136E-13   |
|                                    | pre     | Linear | .128                    | 1  | .128        |
| factor * Readability               | con     | Linear | .128                    | 1  | .128        |
|                                    | dec     | Linear | .110                    | 1  | .110        |
|                                    | mem     | Linear | .167                    | 1  | .167        |

|                                   |     |        |        |    |      |
|-----------------------------------|-----|--------|--------|----|------|
| factor * Forumorder               | pre | Linear | .003   | 1  | .003 |
|                                   | con | Linear | .440   | 1  | .440 |
|                                   | dec | Linear | .016   | 1  | .016 |
|                                   | mem | Linear | .211   | 1  | .211 |
| factor * Readability * Forumorder | pre | Linear | .167   | 1  | .167 |
|                                   | con | Linear | .440   | 1  | .440 |
|                                   | dec | Linear | .990   | 1  | .990 |
|                                   | mem | Linear | .440   | 1  | .440 |
| Error(factor)                     | pre | Linear | .010   | 1  | .010 |
|                                   | con | Linear | 10.365 | 44 | .236 |
|                                   | dec | Linear | 11.586 | 44 | .263 |
|                                   | mem | Linear | 11.370 | 44 | .258 |
|                                   | pre | Linear | 11.755 | 44 | .267 |

#### Tests of Within-Subjects Contrasts

| Source                            | Measure | factor | F     | Sig.  | Partial Eta Squared |
|-----------------------------------|---------|--------|-------|-------|---------------------|
| factor                            | con     | Linear | .276  | .602  | .006                |
|                                   | dec     | Linear | .062  | .805  | .001                |
|                                   | mem     | Linear | .000  | 1.000 | .000                |
|                                   | pre     | Linear | .478  | .493  | .011                |
| factor * Readability              | con     | Linear | .542  | .466  | .012                |
|                                   | dec     | Linear | .418  | .521  | .009                |
|                                   | mem     | Linear | .645  | .426  | .014                |
|                                   | pre     | Linear | .010  | .922  | .000                |
| factor * Forumorder               | con     | Linear | 1.868 | .179  | .041                |
|                                   | dec     | Linear | .062  | .805  | .001                |
|                                   | mem     | Linear | .816  | .371  | .018                |
|                                   | pre     | Linear | .624  | .434  | .014                |
| factor * Readability * Forumorder | con     | Linear | 1.868 | .179  | .041                |
|                                   | dec     | Linear | 3.761 | .059  | .079                |
|                                   | mem     | Linear | 1.703 | .199  | .037                |
|                                   | pre     | Linear | .039  | .844  | .001                |
| Error(factor)                     | con     | Linear |       |       |                     |
|                                   | dec     | Linear |       |       |                     |
|                                   | mem     | Linear |       |       |                     |
|                                   | pre     | Linear |       |       |                     |

#### Tests of Within-Subjects Contrasts

| Source | Measure | factor | Noncent. Parameter | Observed Power <sup>a</sup> |
|--------|---------|--------|--------------------|-----------------------------|
| factor | con     | Linear | .276               | .081                        |

|                                   |     |        |       |      |
|-----------------------------------|-----|--------|-------|------|
|                                   | dec | Linear | .062  | .057 |
|                                   | mem | Linear | .000  | .050 |
|                                   | pre | Linear | .478  | .104 |
| factor * Readability              | con | Linear | .542  | .111 |
|                                   | dec | Linear | .418  | .097 |
|                                   | mem | Linear | .645  | .123 |
|                                   | pre | Linear | .010  | .051 |
| factor * Forumorder               | con | Linear | 1.868 | .267 |
|                                   | dec | Linear | .062  | .057 |
|                                   | mem | Linear | .816  | .143 |
|                                   | pre | Linear | .624  | .121 |
| factor * Readability * Forumorder | con | Linear | 1.868 | .267 |
|                                   | dec | Linear | 3.761 | .475 |
|                                   | mem | Linear | 1.703 | .248 |
|                                   | pre | Linear | .039  | .054 |
| Error(factor)                     | con | Linear |       |      |
|                                   | dec | Linear |       |      |
|                                   | mem | Linear |       |      |
|                                   | pre | Linear |       |      |

a. Computed using alpha = .05

**Levene's Test of Equality of Error Variances<sup>a</sup>**

|             | F     | df1 | df2 | Sig. |
|-------------|-------|-----|-----|------|
| ConsensusA  | 1.369 | 3   | 44  | .265 |
| ConsensusB  | 1.051 | 3   | 44  | .379 |
| DecisionA   | .476  | 3   | 44  | .700 |
| DecisionB   | 1.155 | 3   | 44  | .338 |
| MembershipA | .231  | 3   | 44  | .875 |
| MembershipB | 1.735 | 3   | 44  | .174 |
| PressureA   | 1.497 | 3   | 44  | .229 |
| PressureB   | 2.918 | 3   | 44  | .045 |

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.<sup>a</sup>

a. Design: Intercept + Readability + Forumorder + Readability \* Forumorder

Within Subjects Design: factor

### Tests of Between-Subjects Effects

Transformed Variable: Average

| Source                   | Measure | Type III Sum of Squares | df | Mean Square | F         |
|--------------------------|---------|-------------------------|----|-------------|-----------|
| Intercept                | con     | 3768.773                | 1  | 3768.773    | 13123.907 |
|                          | dec     | 3641.423                | 1  | 3641.423    | 14095.183 |
|                          | mem     | 3632.190                | 1  | 3632.190    | 15123.086 |
|                          | pre     | 3750.000                | 1  | 3750.000    | 16271.186 |
| Readability              | con     | .003                    | 1  | .003        | .009      |
|                          | dec     | .006                    | 1  | .006        | .023      |
|                          | mem     | .003                    | 1  | .003        | .011      |
|                          | pre     | .042                    | 1  | .042        | .181      |
| Forumorder               | con     | .586                    | 1  | .586        | 2.040     |
|                          | dec     | .626                    | 1  | .626        | 2.422     |
|                          | mem     | .260                    | 1  | .260        | 1.084     |
|                          | pre     | .003                    | 1  | .003        | .011      |
| Readability * Forumorder | con     | 2.190                   | 1  | 2.190       | 7.627     |
|                          | dec     | 2.423                   | 1  | 2.423       | 9.377     |
|                          | mem     | 2.667                   | 1  | 2.667       | 11.103    |
|                          | pre     | 1.628                   | 1  | 1.628       | 7.062     |
| Error                    | con     | 12.635                  | 44 | .287        |           |
|                          | dec     | 11.367                  | 44 | .258        |           |
|                          | mem     | 10.568                  | 44 | .240        |           |
|                          | pre     | 10.141                  | 44 | .230        |           |

### Tests of Between-Subjects Effects

Transformed Variable: Average

| Source      | Measure | Sig. | Partial Eta Squared | Noncent. Parameter | Observed Power <sup>a</sup> |
|-------------|---------|------|---------------------|--------------------|-----------------------------|
| Intercept   | con     | .000 | .997                | 13123.907          | 1.000                       |
|             | dec     | .000 | .997                | 14095.183          | 1.000                       |
|             | mem     | .000 | .997                | 15123.086          | 1.000                       |
|             | pre     | .000 | .997                | 16271.186          | 1.000                       |
| Readability | con     | .925 | .000                | .009               | .051                        |
|             | dec     | .881 | .001                | .023               | .052                        |
|             | mem     | .918 | .000                | .011               | .051                        |
|             | pre     | .673 | .004                | .181               | .070                        |
| Forumorder  | con     | .160 | .044                | 2.040              | .287                        |
|             | dec     | .127 | .052                | 2.422              | .331                        |
|             | mem     | .303 | .024                | 1.084              | .175                        |

|                          |     |      |      |        |      |
|--------------------------|-----|------|------|--------|------|
|                          | pre | .916 | .000 | .011   | .051 |
| Readability * Forumorder | con | .008 | .148 | 7.627  | .771 |
|                          | dec | .004 | .176 | 9.377  | .850 |
|                          | mem | .002 | .201 | 11.103 | .903 |
|                          | pre | .011 | .138 | 7.062  | .739 |
| Error                    | con |      |      |        |      |
|                          | dec |      |      |        |      |
|                          | mem |      |      |        |      |
|                          | pre |      |      |        |      |

a. Computed using alpha = .05

## Estimated Marginal Means

| Readability * Forumorder * factor |             |            |        |       |            |                         |
|-----------------------------------|-------------|------------|--------|-------|------------|-------------------------|
| Measure                           | Readability | Forumorder | factor | Mean  | Std. Error | 95% Confidence Interval |
|                                   |             |            |        |       |            | Lower Bound             |
| con                               | High        | FTF-CMC    | 1      | 6.188 | .110       | 5.965                   |
|                                   |             |            | 2      | 6.208 | .177       | 5.851                   |
|                                   |             | CMC-FTF    | 1      | 6.333 | .110       | 6.111                   |
|                                   |             |            | 2      | 6.354 | .177       | 5.997                   |
|                                   | Low         | FTF-CMC    | 1      | 6.688 | .110       | 6.465                   |
|                                   |             |            | 2      | 6.292 | .177       | 5.935                   |
|                                   |             | CMC-FTF    | 1      | 5.958 | .110       | 5.736                   |
|                                   |             |            | 2      | 6.104 | .177       | 5.747                   |
| dec                               | High        | FTF-CMC    | 1      | 5.938 | .112       | 5.712                   |
|                                   |             |            | 2      | 6.208 | .176       | 5.854                   |
|                                   |             | CMC-FTF    | 1      | 6.271 | .112       | 6.046                   |
|                                   |             |            | 2      | 6.188 | .176       | 5.833                   |
|                                   | Low         | FTF-CMC    | 1      | 6.542 | .112       | 6.316                   |
|                                   |             |            | 2      | 6.271 | .176       | 5.916                   |
|                                   |             | CMC-FTF    | 1      | 5.833 | .112       | 5.608                   |
|                                   |             |            | 2      | 6.021 | .176       | 5.666                   |
| mem                               | High        | FTF-CMC    | 1      | 5.979 | .108       | 5.761                   |
|                                   |             |            | 2      | 6.104 | .173       | 5.756                   |

|     |      |         |   |       |      |       |
|-----|------|---------|---|-------|------|-------|
| pre | Low  | CMC-FTF | 1 | 6.250 | .108 | 6.032 |
|     |      |         | 2 | 6.292 | .173 | 5.943 |
|     |      | FTF-CMC | 1 | 6.521 | .108 | 6.303 |
|     |      |         | 2 | 6.208 | .173 | 5.860 |
|     | High | CMC-FTF | 1 | 5.854 | .108 | 5.636 |
|     |      |         | 2 | 6.000 | .173 | 5.652 |
|     |      | FTF-CMC | 1 | 6.167 | .101 | 5.963 |
|     |      |         | 2 | 6.042 | .177 | 5.686 |
|     |      | CMC-FTF | 1 | 6.354 | .101 | 6.150 |
|     |      |         | 2 | 6.354 | .177 | 5.998 |
|     |      | FTF-CMC | 1 | 6.500 | .101 | 6.296 |
|     |      |         | 2 | 6.313 | .177 | 5.956 |
|     | Low  | CMC-FTF | 1 | 6.125 | .101 | 5.921 |
|     |      |         | 2 | 6.146 | .177 | 5.790 |

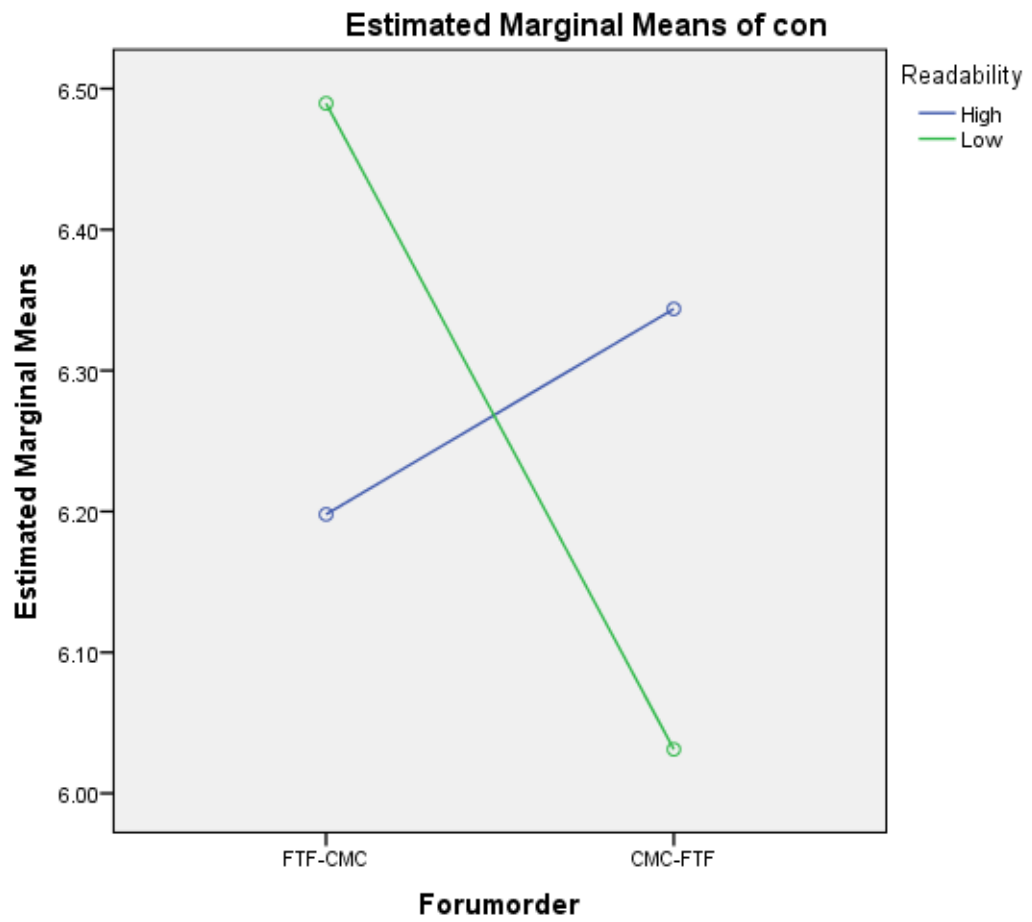
**Readability \* Forumorder \* factor**

|         |             |            |        | 95% Confidence Interval |
|---------|-------------|------------|--------|-------------------------|
| Measure | Readability | Forumorder | factor | Upper Bound             |
| con     | High        | FTF-CMC    | 1      | 6.410                   |
|         |             |            | 2      | 6.565                   |
|         |             | CMC-FTF    | 1      | 6.556                   |
|         |             |            | 2      | 6.711                   |
|         | Low         | FTF-CMC    | 1      | 6.910                   |
|         |             |            | 2      | 6.649                   |
|         |             | CMC-FTF    | 1      | 6.181                   |
|         |             |            | 2      | 6.461                   |
| dec     | High        | FTF-CMC    | 1      | 6.163                   |
|         |             |            | 2      | 6.563                   |
|         |             | CMC-FTF    | 1      | 6.496                   |
|         |             |            | 2      | 6.542                   |
|         | Low         | FTF-CMC    | 1      | 6.767                   |
|         |             |            | 2      | 6.626                   |
|         |             | CMC-FTF    | 1      | 6.059                   |
|         |             |            | 2      | 6.376                   |
| mem     | High        | FTF-CMC    | 1      | 6.197                   |
|         |             |            | 2      | 6.452                   |
|         |             | CMC-FTF    | 1      | 6.468                   |
|         |             |            | 2      | 6.640                   |
|         | Low         | FTF-CMC    | 1      | 6.739                   |
|         |             |            | 2      | 6.557                   |

|     |      |         |   |       |
|-----|------|---------|---|-------|
| pre | High | CMC-FTF | 1 | 6.072 |
|     |      |         | 2 | 6.348 |
|     |      | FTF-CMC | 1 | 6.371 |
|     |      |         | 2 | 6.398 |
|     | Low  | CMC-FTF | 1 | 6.558 |
|     |      |         | 2 | 6.710 |
|     |      | FTF-CMC | 1 | 6.704 |
|     |      |         | 2 | 6.669 |
|     |      | CMC-FTF | 1 | 6.329 |
|     |      |         | 2 | 6.502 |

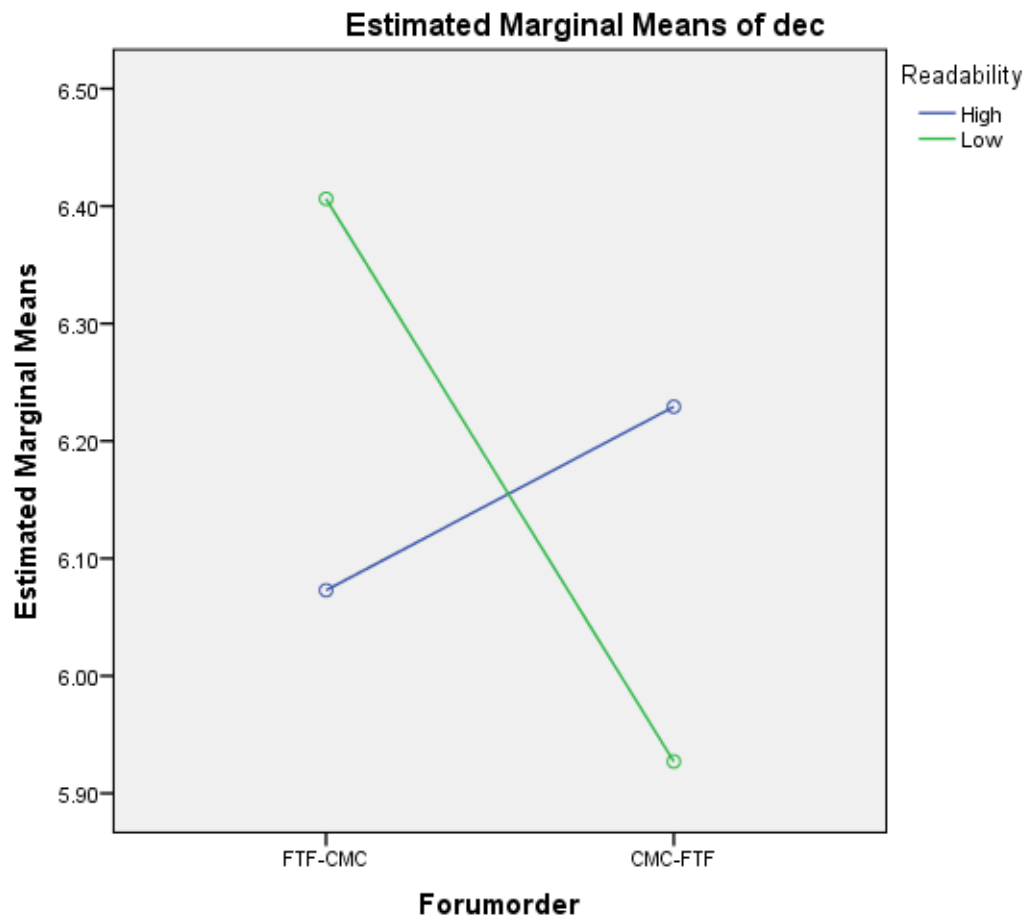
## Profile Plots

con

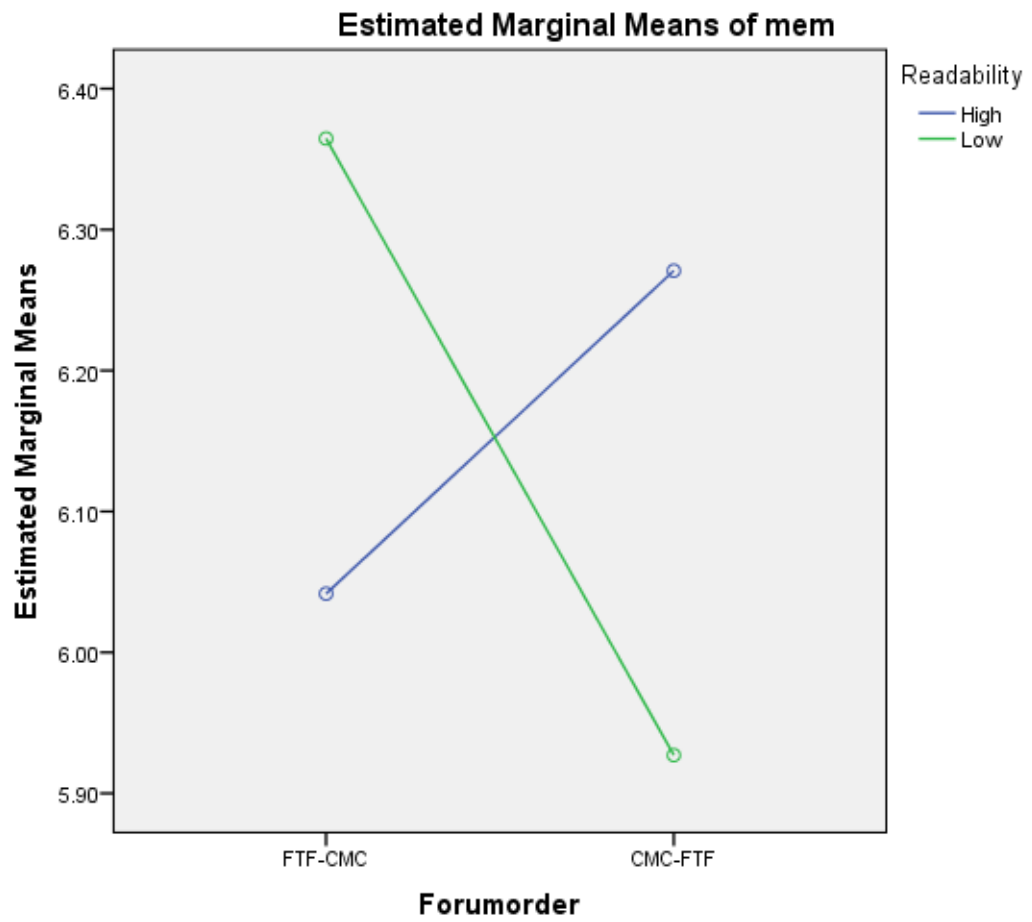


**dec**

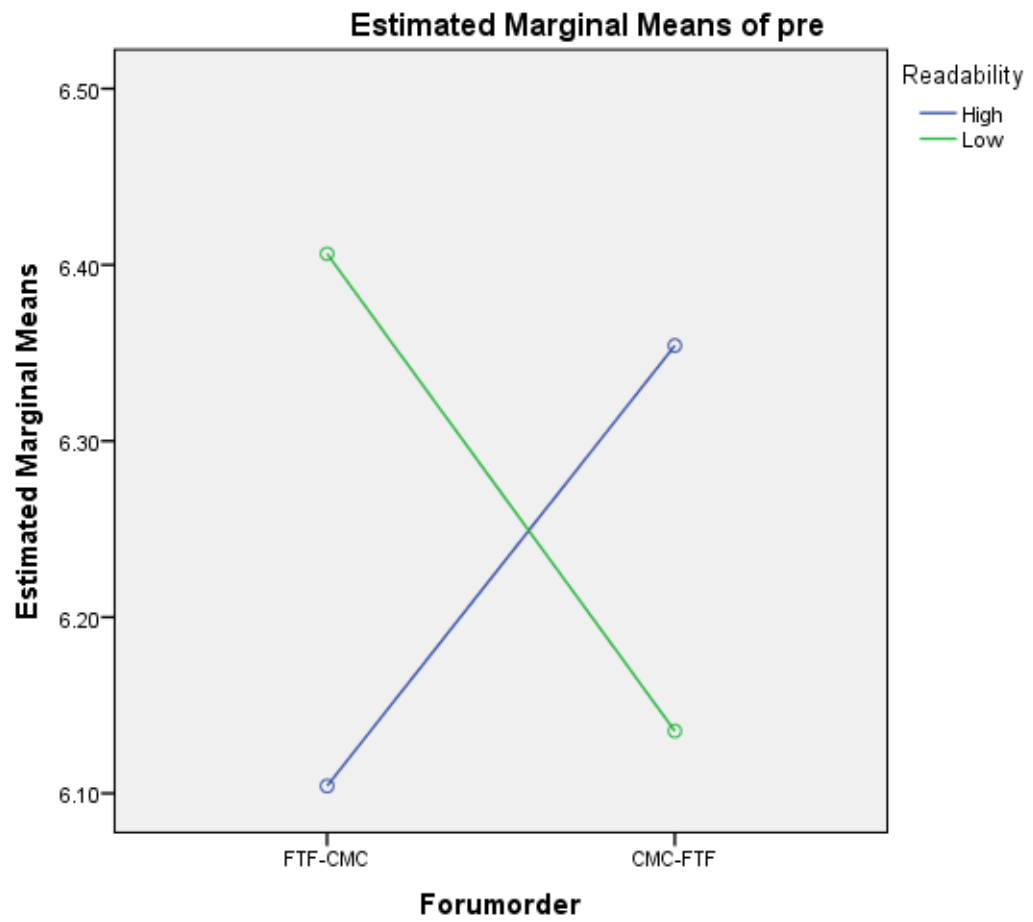




**mem**



pre



## SPSS full output Study 2

```
GLM ConsensusA ConsensusB DecisionA MembershipA DecisionB
MembershipB PressureA PressureB BY Readability Forumorder
  /WSFACTOR=factor 2 Polynomial
  /MEASURE=con dec mem pre
  /METHOD=SSTYPE(3)
  /PLOT=PROFILE(Forumorder*Readability)
  /EMMEANS=TABLES(Readability*Forumorder*factor)
  /PRINT=DESCRIPTIVE ETASQ OPOWER HOMOGENEITY
  /CRITERIA=ALPHA(.05)
  /WSDESIGN=factor
  /DESIGN=Readability Forumorder Readability*Forumorder.
```

## General Linear Model

| Notes                  |                           |   |
|------------------------|---------------------------|---|
| Output Created         |                           | 07-SEP-2015 16:04:55  |
| Comments               |                           |   |
| Input                  | Data                      | G:\Results\Spss output\Study2.sav   |
|                        | Active Dataset            | DataSet1  |
|                        | Filter                    | <none>  |
|                        | Weight                    | <none>  |
|                        | Split File                | <none>  |
|                        | N of Rows in Working Data | 48  |
|                        | File                      |   |
| Missing Value Handling | Definition of Missing     | User-defined missing values are treated as missing.                               |
|                        | Cases Used                | Statistics are based on all cases with valid data for all variables in the model. |

|           |                |  |
|-----------|----------------|--|
| Syntax    |                | GLM ConsensusA ConsensusB<br>DecisionA MembershipA DecisionB<br>MembershipB PressureA PressureB BY<br>Readability Forumorder<br>/WSFACTOR=factor 2 Polynomial<br>/MEASURE=con dec mem pre<br>/METHOD=SSTYPE(3)<br><br>/PLOT=PROFILE(Forumorder*Readabil<br>ity)<br><br>/EMMEANS=TABLES(Readability*Foru<br>morder*factor)<br>/PRINT=DESCRIPTIVE ETASQ<br>OPOWER HOMOGENEITY<br>/CRITERIA=ALPHA(.05)<br>/WSDESIGN=factor<br>/DESIGN=Readability Forumorder<br>Readability*Forumorder. |
| Resources | Processor Time | 00:00:00.41  |
|           | Elapsed Time   | 00:00:00.44  |

[DataSet1] G:\Results\Spss output\Study2.sav

| Within-Subjects Factors |        |                    |
|-------------------------|--------|--------------------|
| Measure                 | factor | Dependent Variable |
| con                     | 1      | ConsensusA         |
|                         | 2      | ConsensusB         |
| dec                     | 1      | DecisionA          |
|                         | 2      | MembershipA        |
| mem                     | 1      | DecisionB          |
|                         | 2      | MembershipB        |
| pre                     | 1      | PressureA          |
|                         | 2      | PressureB          |

#### Between-Subjects Factors

|             |      | Value Label | N  |
|-------------|------|-------------|----|
| Readability | 1.00 | High        | 24 |
|             | 2.00 | Low         | 24 |
| Forumorder  | 1.00 | FTF-CMC     | 24 |
|             | 2.00 | CMC-FTF     | 24 |

#### Descriptive Statistics

|             | Readability | Forumorder | Mean   | Std. Deviation | N  |
|-------------|-------------|------------|--------|----------------|----|
| ConsensusA  | High        | FTF-CMC    | 5.6042 | 1.15039        | 12 |
|             |             | CMC-FTF    | 5.3542 | 1.95244        | 12 |
|             |             | Total      | 5.4792 | 1.57238        | 24 |
|             | Low         | FTF-CMC    | 6.5833 | .52585         | 12 |
|             |             | CMC-FTF    | 4.7292 | .78667         | 12 |
|             |             | Total      | 5.6562 | 1.15112        | 24 |
|             | Total       | FTF-CMC    | 6.0938 | 1.00761        | 24 |
|             |             | CMC-FTF    | 5.0417 | 1.49031        | 24 |
|             |             | Total      | 5.5677 | 1.36614        | 48 |
| ConsensusB  | High        | FTF-CMC    | 6.0833 | .55732         | 12 |
|             |             | CMC-FTF    | 5.7292 | 1.44387        | 12 |
|             |             | Total      | 5.9062 | 1.08551        | 24 |
|             | Low         | FTF-CMC    | 5.2292 | 1.03605        | 12 |
|             |             | CMC-FTF    | 5.2292 | 2.28746        | 12 |
|             |             | Total      | 5.2292 | 1.73662        | 24 |
|             | Total       | FTF-CMC    | 5.6563 | .92317         | 24 |
|             |             | CMC-FTF    | 5.4792 | 1.88806        | 24 |
|             |             | Total      | 5.5677 | 1.47293        | 48 |
| DecisionA   | High        | FTF-CMC    | 5.0208 | 1.28124        | 12 |
|             |             | CMC-FTF    | 5.2083 | 1.90345        | 12 |
|             |             | Total      | 5.1146 | 1.58967        | 24 |
|             | Low         | FTF-CMC    | 6.5417 | .42417         | 12 |
|             |             | CMC-FTF    | 4.5000 | .89823         | 12 |
|             |             | Total      | 5.5208 | 1.24873        | 24 |
|             | Total       | FTF-CMC    | 5.7813 | 1.21430        | 24 |
|             |             | CMC-FTF    | 4.8542 | 1.49985        | 24 |
|             |             | Total      | 5.3177 | 1.42894        | 48 |
| MembershipA | High        | FTF-CMC    | 4.7917 | 1.29173        | 12 |
|             |             | CMC-FTF    | 4.9792 | 2.13056        | 12 |
|             |             | Total      | 4.8854 | 1.72573        | 24 |

|             |           |         |         |         |         |    |
|-------------|-----------|---------|---------|---------|---------|----|
|             | Low       | FTF-CMC | 6.5625  | .38620  | 12      |    |
|             |           | CMC-FTF | 4.5208  | .96211  | 12      |    |
|             |           | Total   | 5.5417  | 1.26548 | 24      |    |
|             | Total     | FTF-CMC | 5.6771  | 1.29899 | 24      |    |
|             |           | CMC-FTF | 4.7500  | 1.63355 | 24      |    |
|             |           | Total   | 5.2135  | 1.53331 | 48      |    |
|             | DecisionB | High    | FTF-CMC | 6.0625  | .59472  | 12 |
|             |           |         | CMC-FTF | 5.2708  | 1.61477 | 12 |
|             |           |         | Total   | 5.6667  | 1.25687 | 24 |
| Low         |           | FTF-CMC | 5.1042  | 1.16998 | 12      |    |
|             |           | CMC-FTF | 5.1042  | 2.29242 | 12      |    |
|             |           | Total   | 5.1042  | 1.77989 | 24      |    |
| Total       |           | FTF-CMC | 5.5833  | 1.03122 | 24      |    |
|             |           | CMC-FTF | 5.1875  | 1.94105 | 24      |    |
|             |           | Total   | 5.3854  | 1.55053 | 48      |    |
| MembershipB | High      | FTF-CMC | 5.8750  | .60772  | 12      |    |
|             |           | CMC-FTF | 5.5417  | 1.33499 | 12      |    |
|             |           | Total   | 5.7083  | 1.02858 | 24      |    |
|             | Low       | FTF-CMC | 5.2917  | 1.04356 | 12      |    |
|             |           | CMC-FTF | 5.2708  | 2.27750 | 12      |    |
|             |           | Total   | 5.2813  | 1.73254 | 24      |    |
|             | Total     | FTF-CMC | 5.5833  | .88670  | 24      |    |
|             |           | CMC-FTF | 5.4063  | 1.83091 | 24      |    |
|             |           | Total   | 5.4948  | 1.42591 | 48      |    |
| PressureA   | High      | FTF-CMC | 4.5417  | 1.49177 | 12      |    |
|             |           | CMC-FTF | 5.0417  | 2.04726 | 12      |    |
|             |           | Total   | 4.7917  | 1.77033 | 24      |    |
|             | Low       | FTF-CMC | 6.0000  | 1.52628 | 12      |    |
|             |           | CMC-FTF | 4.6458  | 1.38768 | 12      |    |
|             |           | Total   | 5.3229  | 1.58539 | 24      |    |
|             | Total     | FTF-CMC | 5.2708  | 1.65325 | 24      |    |
|             |           | CMC-FTF | 4.8437  | 1.72232 | 24      |    |
|             |           | Total   | 5.0573  | 1.68397 | 48      |    |
| PressureB   | High      | FTF-CMC | 3.8750  | 2.03799 | 12      |    |
|             |           | CMC-FTF | 4.1042  | 1.73027 | 12      |    |
|             |           | Total   | 3.9896  | 1.85255 | 24      |    |
|             | Low       | FTF-CMC | 4.2917  | 1.47646 | 12      |    |
|             |           | CMC-FTF | 3.9167  | 2.39871 | 12      |    |
|             |           | Total   | 4.1042  | 1.95731 | 24      |    |
|             | Total     | FTF-CMC | 4.0833  | 1.75336 | 24      |    |
|             |           |         |         |         |         |    |

|         |        |         |    |
|---------|--------|---------|----|
| CMC-FTF | 4.0104 | 2.04764 | 24 |
| Total   | 4.0469 | 1.88616 | 48 |

**Box's Test of Equality  
of Covariance**

**Matrices<sup>a</sup>**

|         |          |
|---------|----------|
| Box's M | 255.048  |
| F       | 1.552    |
| df1     | 108      |
| df2     | 4300.643 |
| Sig.    | .000     |

Tests the null hypothesis  
that the observed  
covariance matrices of  
the dependent variables  
are equal across  
groups.<sup>a</sup>

a. Design: Intercept +  
Readability +  
Forumorder +  
Readability \* Forumorder  
Within Subjects Design:  
factor

**Multivariate Tests<sup>a</sup>**

| Effect           |             |                    | Value  | F                    |
|------------------|-------------|--------------------|--------|----------------------|
| Between Subjects | Intercept   | Pillai's Trace     | .971   | 344.667 <sup>b</sup> |
|                  |             | Wilks' Lambda      | .029   | 344.667 <sup>b</sup> |
|                  |             | Hotelling's Trace  | 33.626 | 344.667 <sup>b</sup> |
|                  |             | Roy's Largest Root | 33.626 | 344.667 <sup>b</sup> |
|                  | Readability | Pillai's Trace     | .148   | 1.776 <sup>b</sup>   |
|                  |             | Wilks' Lambda      | .852   | 1.776 <sup>b</sup>   |
|                  |             | Hotelling's Trace  | .173   | 1.776 <sup>b</sup>   |
|                  |             | Roy's Largest Root | .173   | 1.776 <sup>b</sup>   |
|                  | Forumorder  | Pillai's Trace     | .155   | 1.879 <sup>b</sup>   |
|                  |             | Wilks' Lambda      | .845   | 1.879 <sup>b</sup>   |
|                  |             | Hotelling's Trace  | .183   | 1.879 <sup>b</sup>   |



|                 |                                      |                    |      |                    |
|-----------------|--------------------------------------|--------------------|------|--------------------|
|                 |                                      | Roy's Largest Root | .183 | 1.879 <sup>b</sup> |
| Within Subjects | Readability * Forumorder             | Pillai's Trace     | .220 | 2.899 <sup>b</sup> |
|                 |                                      | Wilks' Lambda      | .780 | 2.899 <sup>b</sup> |
|                 |                                      | Hotelling's Trace  | .283 | 2.899 <sup>b</sup> |
|                 |                                      | Roy's Largest Root | .283 | 2.899 <sup>b</sup> |
|                 |                                      |                    |      |                    |
|                 | factor                               | Pillai's Trace     | .207 | 2.682 <sup>b</sup> |
|                 |                                      | Wilks' Lambda      | .793 | 2.682 <sup>b</sup> |
|                 |                                      | Hotelling's Trace  | .262 | 2.682 <sup>b</sup> |
|                 |                                      | Roy's Largest Root | .262 | 2.682 <sup>b</sup> |
|                 | factor * Readability                 | Pillai's Trace     | .112 | 1.290 <sup>b</sup> |
|                 |                                      | Wilks' Lambda      | .888 | 1.290 <sup>b</sup> |
|                 |                                      | Hotelling's Trace  | .126 | 1.290 <sup>b</sup> |
|                 |                                      | Roy's Largest Root | .126 | 1.290 <sup>b</sup> |
|                 | factor * Forumorder                  | Pillai's Trace     | .112 | 1.289 <sup>b</sup> |
|                 |                                      | Wilks' Lambda      | .888 | 1.289 <sup>b</sup> |
|                 |                                      | Hotelling's Trace  | .126 | 1.289 <sup>b</sup> |
|                 |                                      | Roy's Largest Root | .126 | 1.289 <sup>b</sup> |
|                 | factor * Readability *<br>Forumorder | Pillai's Trace     | .125 | 1.461 <sup>b</sup> |
|                 |                                      | Wilks' Lambda      | .875 | 1.461 <sup>b</sup> |
|                 |                                      | Hotelling's Trace  | .143 | 1.461 <sup>b</sup> |
|                 |                                      | Roy's Largest Root | .143 | 1.461 <sup>b</sup> |

#### Multivariate Tests<sup>a</sup>

| Effect           |                          |                    | Hypothesis df | Error df |
|------------------|--------------------------|--------------------|---------------|----------|
| Between Subjects | Intercept                | Pillai's Trace     | 4.000         | 41.000   |
|                  |                          | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                          | Hotelling's Trace  | 4.000         | 41.000   |
|                  |                          | Roy's Largest Root | 4.000         | 41.000   |
|                  | Readability              | Pillai's Trace     | 4.000         | 41.000   |
|                  |                          | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                          | Hotelling's Trace  | 4.000         | 41.000   |
|                  |                          | Roy's Largest Root | 4.000         | 41.000   |
|                  | Forumorder               | Pillai's Trace     | 4.000         | 41.000   |
|                  |                          | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                          | Hotelling's Trace  | 4.000         | 41.000   |
|                  |                          | Roy's Largest Root | 4.000         | 41.000   |
|                  | Readability * Forumorder | Pillai's Trace     | 4.000         | 41.000   |
|                  |                          | Wilks' Lambda      | 4.000         | 41.000   |
|                  |                          | Hotelling's Trace  | 4.000         | 41.000   |

|                 |                                      |                    |       |        |
|-----------------|--------------------------------------|--------------------|-------|--------|
|                 |                                      | Roy's Largest Root | 4.000 | 41.000 |
| Within Subjects | factor                               | Pillai's Trace     | 4.000 | 41.000 |
|                 |                                      | Wilks' Lambda      | 4.000 | 41.000 |
|                 |                                      | Hotelling's Trace  | 4.000 | 41.000 |
|                 |                                      | Roy's Largest Root | 4.000 | 41.000 |
|                 | factor * Readability                 | Pillai's Trace     | 4.000 | 41.000 |
|                 |                                      | Wilks' Lambda      | 4.000 | 41.000 |
|                 |                                      | Hotelling's Trace  | 4.000 | 41.000 |
|                 |                                      | Roy's Largest Root | 4.000 | 41.000 |
|                 | factor * Forumorder                  | Pillai's Trace     | 4.000 | 41.000 |
|                 |                                      | Wilks' Lambda      | 4.000 | 41.000 |
|                 |                                      | Hotelling's Trace  | 4.000 | 41.000 |
|                 |                                      | Roy's Largest Root | 4.000 | 41.000 |
|                 | factor * Readability *<br>Forumorder | Pillai's Trace     | 4.000 | 41.000 |
|                 |                                      | Wilks' Lambda      | 4.000 | 41.000 |
|                 |                                      | Hotelling's Trace  | 4.000 | 41.000 |
|                 |                                      | Roy's Largest Root | 4.000 | 41.000 |

#### Multivariate Tests<sup>a</sup>

| Effect           |                          |                    | Sig. | Partial Eta Squared |
|------------------|--------------------------|--------------------|------|---------------------|
| Between Subjects | Intercept                | Pillai's Trace     | .000 | .971                |
|                  |                          | Wilks' Lambda      | .000 | .971                |
|                  |                          | Hotelling's Trace  | .000 | .971                |
|                  |                          | Roy's Largest Root | .000 | .971                |
|                  | Readability              | Pillai's Trace     | .152 | .148                |
|                  |                          | Wilks' Lambda      | .152 | .148                |
|                  |                          | Hotelling's Trace  | .152 | .148                |
|                  |                          | Roy's Largest Root | .152 | .148                |
|                  | Forumorder               | Pillai's Trace     | .132 | .155                |
|                  |                          | Wilks' Lambda      | .132 | .155                |
|                  |                          | Hotelling's Trace  | .132 | .155                |
|                  |                          | Roy's Largest Root | .132 | .155                |
|                  | Readability * Forumorder | Pillai's Trace     | .033 | .220                |
|                  |                          | Wilks' Lambda      | .033 | .220                |
|                  |                          | Hotelling's Trace  | .033 | .220                |
|                  |                          | Roy's Largest Root | .033 | .220                |
| Within Subjects  | factor                   | Pillai's Trace     | .045 | .207                |
|                  |                          | Wilks' Lambda      | .045 | .207                |

|                                      |                    |      |      |
|--------------------------------------|--------------------|------|------|
|                                      | Hotelling's Trace  | .045 | .207 |
|                                      | Roy's Largest Root | .045 | .207 |
| factor * Readability                 | Pillai's Trace     | .290 | .112 |
|                                      | Wilks' Lambda      | .290 | .112 |
|                                      | Hotelling's Trace  | .290 | .112 |
|                                      | Roy's Largest Root | .290 | .112 |
| factor * Forumorder                  | Pillai's Trace     | .290 | .112 |
|                                      | Wilks' Lambda      | .290 | .112 |
|                                      | Hotelling's Trace  | .290 | .112 |
|                                      | Roy's Largest Root | .290 | .112 |
| factor * Readability *<br>Forumorder | Pillai's Trace     | .232 | .125 |
|                                      | Wilks' Lambda      | .232 | .125 |
|                                      | Hotelling's Trace  | .232 | .125 |
|                                      | Roy's Largest Root | .232 | .125 |

#### Multivariate Tests<sup>a</sup>

| Effect           |                          |                    | Noncent.<br>Parameter | Observed<br>Power <sup>c</sup> |
|------------------|--------------------------|--------------------|-----------------------|--------------------------------|
| Between Subjects | Intercept                | Pillai's Trace     | 1378.668              | 1.000                          |
|                  |                          | Wilks' Lambda      | 1378.668              | 1.000                          |
|                  |                          | Hotelling's Trace  | 1378.668              | 1.000                          |
|                  |                          | Roy's Largest Root | 1378.668              | 1.000                          |
|                  | Readability              | Pillai's Trace     | 7.105                 | .494                           |
|                  |                          | Wilks' Lambda      | 7.105                 | .494                           |
|                  |                          | Hotelling's Trace  | 7.105                 | .494                           |
|                  |                          | Roy's Largest Root | 7.105                 | .494                           |
|                  | Forumorder               | Pillai's Trace     | 7.517                 | .520                           |
|                  |                          | Wilks' Lambda      | 7.517                 | .520                           |
|                  |                          | Hotelling's Trace  | 7.517                 | .520                           |
|                  |                          | Roy's Largest Root | 7.517                 | .520                           |
|                  | Readability * Forumorder | Pillai's Trace     | 11.596                | .732                           |
|                  |                          | Wilks' Lambda      | 11.596                | .732                           |
|                  |                          | Hotelling's Trace  | 11.596                | .732                           |
|                  |                          | Roy's Largest Root | 11.596                | .732                           |
| Within Subjects  | factor                   | Pillai's Trace     | 10.726                | .694                           |
|                  |                          | Wilks' Lambda      | 10.726                | .694                           |
|                  |                          | Hotelling's Trace  | 10.726                | .694                           |
|                  |                          | Roy's Largest Root | 10.726                | .694                           |
|                  | factor * Readability     | Pillai's Trace     | 5.159                 | .366                           |

|                                      |                    |       |      |
|--------------------------------------|--------------------|-------|------|
|                                      | Wilks' Lambda      | 5.159 | .366 |
|                                      | Hotelling's Trace  | 5.159 | .366 |
|                                      | Roy's Largest Root | 5.159 | .366 |
| factor * Forumorder                  | Pillai's Trace     | 5.154 | .366 |
|                                      | Wilks' Lambda      | 5.154 | .366 |
|                                      | Hotelling's Trace  | 5.154 | .366 |
|                                      | Roy's Largest Root | 5.154 | .366 |
| factor * Readability *<br>Forumorder | Pillai's Trace     | 5.845 | .413 |
|                                      | Wilks' Lambda      | 5.845 | .413 |
|                                      | Hotelling's Trace  | 5.845 | .413 |
|                                      | Roy's Largest Root | 5.845 | .413 |

a. Design: Intercept + Readability + Forumorder + Readability \* Forumorder

Within Subjects Design: factor

b. Exact statistic

c. Computed using alpha = .05

**Mauchly's Test of Sphericity<sup>a</sup>**

| Within Subjects Effect | Measure | Mauchly's W | Approx. Chi-Square | df | Sig. |
|------------------------|---------|-------------|--------------------|----|------|
| factor                 | con     | 1.000       | .000               | 0  | .    |
|                        | dec     | 1.000       | .000               | 0  | .    |
|                        | mem     | 1.000       | .000               | 0  | .    |
|                        | pre     | 1.000       | .000               | 0  | .    |

**Mauchly's Test of Sphericity<sup>a</sup>**

| Within Subjects Effect | Measure | Epsilon <sup>b</sup> |             |             |
|------------------------|---------|----------------------|-------------|-------------|
|                        |         | Greenhouse-Geisser   | Huynh-Feldt | Lower-bound |
| factor                 | con     | 1.000                | 1.000       | 1.000       |
|                        | dec     | 1.000                | 1.000       | 1.000       |
|                        | mem     | 1.000                | 1.000       | 1.000       |
|                        | pre     | 1.000                | 1.000       | 1.000       |

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.<sup>a</sup>

a. Design: Intercept + Readability + Forumorder + Readability \* Forumorder

Within Subjects Design: factor

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

## Tests of Within-Subjects Effects

| Multivariate <sup>a,b</sup>          |                    |       |                    |               |          |
|--------------------------------------|--------------------|-------|--------------------|---------------|----------|
| Within Subjects Effect               |                    | Value | F                  | Hypothesis df | Error df |
| factor                               | Pillai's Trace     | .207  | 2.682 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Wilks' Lambda      | .793  | 2.682 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Hotelling's Trace  | .262  | 2.682 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Roy's Largest Root | .262  | 2.682 <sup>c</sup> | 4.000         | 41.000   |
| factor * Readability                 | Pillai's Trace     | .112  | 1.290 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Wilks' Lambda      | .888  | 1.290 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Hotelling's Trace  | .126  | 1.290 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Roy's Largest Root | .126  | 1.290 <sup>c</sup> | 4.000         | 41.000   |
| factor * Forumorder                  | Pillai's Trace     | .112  | 1.289 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Wilks' Lambda      | .888  | 1.289 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Hotelling's Trace  | .126  | 1.289 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Roy's Largest Root | .126  | 1.289 <sup>c</sup> | 4.000         | 41.000   |
| factor * Readability *<br>Forumorder | Pillai's Trace     | .125  | 1.461 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Wilks' Lambda      | .875  | 1.461 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Hotelling's Trace  | .143  | 1.461 <sup>c</sup> | 4.000         | 41.000   |
|                                      | Roy's Largest Root | .143  | 1.461 <sup>c</sup> | 4.000         | 41.000   |

| Multivariate <sup>a,b</sup> |                    |      |                     |                    |
|-----------------------------|--------------------|------|---------------------|--------------------|
| Within Subjects Effect      |                    | Sig. | Partial Eta Squared | Noncent. Parameter |
| factor                      | Pillai's Trace     | .045 | .207                | 10.726             |
|                             | Wilks' Lambda      | .045 | .207                | 10.726             |
|                             | Hotelling's Trace  | .045 | .207                | 10.726             |
|                             | Roy's Largest Root | .045 | .207                | 10.726             |
| factor * Readability        | Pillai's Trace     | .290 | .112                | 5.159              |
|                             | Wilks' Lambda      | .290 | .112                | 5.159              |
|                             | Hotelling's Trace  | .290 | .112                | 5.159              |
|                             | Roy's Largest Root | .290 | .112                | 5.159              |
| factor * Forumorder         | Pillai's Trace     | .290 | .112                | 5.154              |
|                             | Wilks' Lambda      | .290 | .112                | 5.154              |
|                             | Hotelling's Trace  | .290 | .112                | 5.154              |

|                        |                    |      |      |       |
|------------------------|--------------------|------|------|-------|
|                        | Roy's Largest Root | .290 | .112 | 5.154 |
| factor * Readability * | Pillai's Trace     | .232 | .125 | 5.845 |
| Forumorder             | Wilks' Lambda      | .232 | .125 | 5.845 |
|                        | Hotelling's Trace  | .232 | .125 | 5.845 |
|                        | Roy's Largest Root | .232 | .125 | 5.845 |

#### Multivariate<sup>a,b</sup>

| Within Subjects Effect            |                    | Observed Power <sup>d</sup> |
|-----------------------------------|--------------------|-----------------------------|
| factor                            | Pillai's Trace     | .694                        |
|                                   | Wilks' Lambda      | .694                        |
|                                   | Hotelling's Trace  | .694                        |
|                                   | Roy's Largest Root | .694                        |
| factor * Readability              | Pillai's Trace     | .366                        |
|                                   | Wilks' Lambda      | .366                        |
|                                   | Hotelling's Trace  | .366                        |
|                                   | Roy's Largest Root | .366                        |
| factor * Forumorder               | Pillai's Trace     | .366                        |
|                                   | Wilks' Lambda      | .366                        |
|                                   | Hotelling's Trace  | .366                        |
|                                   | Roy's Largest Root | .366                        |
| factor * Readability * Forumorder | Pillai's Trace     | .413                        |
|                                   | Wilks' Lambda      | .413                        |
|                                   | Hotelling's Trace  | .413                        |
|                                   | Roy's Largest Root | .413                        |

a. Design: Intercept + Readability + Forumorder + Readability \* Forumorder

Within Subjects Design: factor

b. Tests are based on averaged variables.

c. Exact statistic

d. Computed using alpha = .05

#### Univariate Tests

| Source | Measure                | Type III Sum of Squares | df    | Mean Square | F    | Sig.  | Partial Eta Squared | Noncent. Parameter | Observed Power <sup>a</sup> |
|--------|------------------------|-------------------------|-------|-------------|------|-------|---------------------|--------------------|-----------------------------|
| factor | con Sphericity Assumed | .000                    | 1     | .000        | .000 | 1.000 | .000                | .000               | .050                        |
|        | Greenhouse-Geisser     | .000                    | 1.000 | .000        | .000 | 1.000 | .000                | .000               | .050                        |
|        | Huynh-Feldt            | .000                    | 1.000 | .000        | .000 | 1.000 | .000                | .000               | .050                        |

|                         |     |                    |        |       |        |       |       |      |       |      |
|-------------------------|-----|--------------------|--------|-------|--------|-------|-------|------|-------|------|
|                         |     | Lower-bound        | .000   | 1.000 | .000   | .000  | 1.000 | .000 | .000  | .050 |
|                         | dec | Sphericity         | .260   | 1     | .260   | .467  | .498  | .010 | .467  | .103 |
|                         |     | Assumed            |        |       |        |       |       |      |       |      |
|                         |     | Greenhouse-Geisser | .260   | 1.000 | .260   | .467  | .498  | .010 | .467  | .103 |
|                         |     | Huynh-Feldt        | .260   | 1.000 | .260   | .467  | .498  | .010 | .467  | .103 |
|                         |     | Lower-bound        | .260   | 1.000 | .260   | .467  | .498  | .010 | .467  | .103 |
|                         | me  | Sphericity         | .287   | 1     | .287   | 1.263 | .267  | .028 | 1.263 | .196 |
|                         | m   | Assumed            |        |       |        |       |       |      |       |      |
|                         |     | Greenhouse-Geisser | .287   | 1.000 | .287   | 1.263 | .267  | .028 | 1.263 | .196 |
|                         |     | Huynh-Feldt        | .287   | 1.000 | .287   | 1.263 | .267  | .028 | 1.263 | .196 |
|                         |     | Lower-bound        | .287   | 1.000 | .287   | 1.263 | .267  | .028 | 1.263 | .196 |
|                         | pre | Sphericity         | 24.503 | 1     | 24.503 | 7.729 | .008  | .149 | 7.729 | .776 |
|                         |     | Assumed            |        |       |        |       |       |      |       |      |
|                         |     | Greenhouse-Geisser | 24.503 | 1.000 | 24.503 | 7.729 | .008  | .149 | 7.729 | .776 |
|                         |     | Huynh-Feldt        | 24.503 | 1.000 | 24.503 | 7.729 | .008  | .149 | 7.729 | .776 |
|                         |     | Lower-bound        | 24.503 | 1.000 | 24.503 | 7.729 | .008  | .149 | 7.729 | .776 |
| factor *<br>Readability | con | Sphericity         | 4.378  | 1     | 4.378  | 3.385 | .073  | .071 | 3.385 | .436 |
|                         |     | Assumed            |        |       |        |       |       |      |       |      |
|                         |     | Greenhouse-Geisser | 4.378  | 1.000 | 4.378  | 3.385 | .073  | .071 | 3.385 | .436 |
|                         |     | Huynh-Feldt        | 4.378  | 1.000 | 4.378  | 3.385 | .073  | .071 | 3.385 | .436 |
|                         |     | Lower-bound        | 4.378  | 1.000 | 4.378  | 3.385 | .073  | .071 | 3.385 | .436 |
|                         | dec | Sphericity         | .375   | 1     | .375   | .672  | .417  | .015 | .672  | .126 |
|                         |     | Assumed            |        |       |        |       |       |      |       |      |
|                         |     | Greenhouse-Geisser | .375   | 1.000 | .375   | .672  | .417  | .015 | .672  | .126 |
|                         |     | Huynh-Feldt        | .375   | 1.000 | .375   | .672  | .417  | .015 | .672  | .126 |
|                         |     | Lower-bound        | .375   | 1.000 | .375   | .672  | .417  | .015 | .672  | .126 |
|                         | me  | Sphericity         | .110   | 1     | .110   | .484  | .490  | .011 | .484  | .105 |
|                         | m   | Assumed            |        |       |        |       |       |      |       |      |
|                         |     | Greenhouse-Geisser | .110   | 1.000 | .110   | .484  | .490  | .011 | .484  | .105 |
|                         |     | Huynh-Feldt        | .110   | 1.000 | .110   | .484  | .490  | .011 | .484  | .105 |
|                         |     | Lower-bound        | .110   | 1.000 | .110   | .484  | .490  | .011 | .484  | .105 |
|                         | pre | Sphericity         | 1.042  | 1     | 1.042  | .329  | .569  | .007 | .329  | .087 |
|                         |     | Assumed            |        |       |        |       |       |      |       |      |
|                         |     | Greenhouse-Geisser | 1.042  | 1.000 | 1.042  | .329  | .569  | .007 | .329  | .087 |

|               |     |                    |       |       |       |       |       |      |       |      |
|---------------|-----|--------------------|-------|-------|-------|-------|-------|------|-------|------|
|               |     | Huynh-Feldt        | 1.042 | 1.000 | 1.042 | .329  | .569  | .007 | .329  | .087 |
|               |     | Lower-bound        | 1.042 | 1.000 | 1.042 | .329  | .569  | .007 | .329  | .087 |
| factor *      | con | Sphericity         | 4.594 | 1     | 4.594 | 3.552 | .066  | .075 | 3.552 | .454 |
|               |     | Assumed            |       |       |       |       |       |      |       |      |
|               |     | Greenhouse-Geisser | 4.594 | 1.000 | 4.594 | 3.552 | .066  | .075 | 3.552 | .454 |
|               |     | Huynh-Feldt        | 4.594 | 1.000 | 4.594 | 3.552 | .066  | .075 | 3.552 | .454 |
|               |     | Lower-bound        | 4.594 | 1.000 | 4.594 | 3.552 | .066  | .075 | 3.552 | .454 |
|               | dec | Sphericity         | .000  | 1     | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               |     | Assumed            |       |       |       |       |       |      |       |      |
|               |     | Greenhouse-Geisser | .000  | 1.000 | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               |     | Huynh-Feldt        | .000  | 1.000 | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               |     | Lower-bound        | .000  | 1.000 | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               | me  | Sphericity         | .287  | 1     | .287  | 1.263 | .267  | .028 | 1.263 | .196 |
|               |     | Assumed            |       |       |       |       |       |      |       |      |
|               |     | Greenhouse-Geisser | .287  | 1.000 | .287  | 1.263 | .267  | .028 | 1.263 | .196 |
|               |     | Huynh-Feldt        | .287  | 1.000 | .287  | 1.263 | .267  | .028 | 1.263 | .196 |
|               |     | Lower-bound        | .287  | 1.000 | .287  | 1.263 | .267  | .028 | 1.263 | .196 |
|               | pre | Sphericity         | .753  | 1     | .753  | .237  | .629  | .005 | .237  | .076 |
|               |     | Assumed            |       |       |       |       |       |      |       |      |
|               |     | Greenhouse-Geisser | .753  | 1.000 | .753  | .237  | .629  | .005 | .237  | .076 |
|               |     | Huynh-Feldt        | .753  | 1.000 | .753  | .237  | .629  | .005 | .237  | .076 |
|               |     | Lower-bound        | .753  | 1.000 | .753  | .237  | .629  | .005 | .237  | .076 |
| factor *      | con | Sphericity         | 5.753 | 1     | 5.753 | 4.448 | .041  | .092 | 4.448 | .541 |
|               |     | Assumed            |       |       |       |       |       |      |       |      |
|               |     | Greenhouse-Geisser | 5.753 | 1.000 | 5.753 | 4.448 | .041  | .092 | 4.448 | .541 |
|               |     | Huynh-Feldt        | 5.753 | 1.000 | 5.753 | 4.448 | .041  | .092 | 4.448 | .541 |
|               |     | Lower-bound        | 5.753 | 1.000 | 5.753 | 4.448 | .041  | .092 | 4.448 | .541 |
|               | dec | Sphericity         | .000  | 1     | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               |     | Assumed            |       |       |       |       |       |      |       |      |
|               |     | Greenhouse-Geisser | .000  | 1.000 | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               |     | Huynh-Feldt        | .000  | 1.000 | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               |     | Lower-bound        | .000  | 1.000 | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               | me  | Sphericity         | .344  | 1     | .344  | 1.515 | .225  | .033 | 1.515 | .226 |
|               |     | Assumed            |       |       |       |       |       |      |       |      |
|               |     |                    |       |       |       |       |       |      |       |      |
| Readability * | con | Sphericity         | 5.753 | 1     | 5.753 | 4.448 | .041  | .092 | 4.448 | .541 |
|               |     | Assumed            |       |       |       |       |       |      |       |      |
|               |     | Greenhouse-Geisser | 5.753 | 1.000 | 5.753 | 4.448 | .041  | .092 | 4.448 | .541 |
|               |     | Huynh-Feldt        | 5.753 | 1.000 | 5.753 | 4.448 | .041  | .092 | 4.448 | .541 |
|               |     | Lower-bound        | 5.753 | 1.000 | 5.753 | 4.448 | .041  | .092 | 4.448 | .541 |
|               | dec | Sphericity         | .000  | 1     | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               |     | Assumed            |       |       |       |       |       |      |       |      |
|               |     | Greenhouse-Geisser | .000  | 1.000 | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               |     | Huynh-Feldt        | .000  | 1.000 | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               |     | Lower-bound        | .000  | 1.000 | .000  | .000  | 1.000 | .000 | .000  | .050 |
|               | me  | Sphericity         | .344  | 1     | .344  | 1.515 | .225  | .033 | 1.515 | .226 |
|               |     | Assumed            |       |       |       |       |       |      |       |      |
|               |     |                    |       |       |       |       |       |      |       |      |



|               |     |                    |         |        |       |       |      |      |       |      |
|---------------|-----|--------------------|---------|--------|-------|-------|------|------|-------|------|
|               |     | Greenhouse-Geisser | .344    | 1.000  | .344  | 1.515 | .225 | .033 | 1.515 | .226 |
|               |     | Huynh-Feldt        | .344    | 1.000  | .344  | 1.515 | .225 | .033 | 1.515 | .226 |
|               |     | Lower-bound        | .344    | 1.000  | .344  | 1.515 | .225 | .033 | 1.515 | .226 |
|               | pre | Sphericity Assumed | 2.344   | 1      | 2.344 | .739  | .395 | .017 | .739  | .134 |
|               |     | Greenhouse-Geisser | 2.344   | 1.000  | 2.344 | .739  | .395 | .017 | .739  | .134 |
|               |     | Huynh-Feldt        | 2.344   | 1.000  | 2.344 | .739  | .395 | .017 | .739  | .134 |
|               |     | Lower-bound        | 2.344   | 1.000  | 2.344 | .739  | .395 | .017 | .739  | .134 |
| Error(factor) | con | Sphericity Assumed | 56.901  | 44     | 1.293 |       |      |      |       |      |
|               |     | Greenhouse-Geisser | 56.901  | 44.000 | 1.293 |       |      |      |       |      |
|               |     | Huynh-Feldt        | 56.901  | 44.000 | 1.293 |       |      |      |       |      |
|               |     | Lower-bound        | 56.901  | 44.000 | 1.293 |       |      |      |       |      |
|               |     |                    |         |        |       |       |      |      |       |      |
|               | dec | Sphericity Assumed | 24.552  | 44     | .558  |       |      |      |       |      |
|               |     | Greenhouse-Geisser | 24.552  | 44.000 | .558  |       |      |      |       |      |
|               |     | Huynh-Feldt        | 24.552  | 44.000 | .558  |       |      |      |       |      |
|               |     | Lower-bound        | 24.552  | 44.000 | .558  |       |      |      |       |      |
|               |     |                    |         |        |       |       |      |      |       |      |
|               | mem | Sphericity Assumed | 10.003  | 44     | .227  |       |      |      |       |      |
|               |     | Greenhouse-Geisser | 10.003  | 44.000 | .227  |       |      |      |       |      |
|               |     | Huynh-Feldt        | 10.003  | 44.000 | .227  |       |      |      |       |      |
|               |     | Lower-bound        | 10.003  | 44.000 | .227  |       |      |      |       |      |
|               |     |                    |         |        |       |       |      |      |       |      |
|               | pre | Sphericity Assumed | 139.484 | 44     | 3.170 |       |      |      |       |      |
|               |     | Greenhouse-Geisser | 139.484 | 44.000 | 3.170 |       |      |      |       |      |
|               |     | Huynh-Feldt        | 139.484 | 44.000 | 3.170 |       |      |      |       |      |
|               |     |                    |         |        |       |       |      |      |       |      |

|             |         |            |       |  |  |  |  |  |
|-------------|---------|------------|-------|--|--|--|--|--|
| Lower-bound | 139.484 | 44.00<br>0 | 3.170 |  |  |  |  |  |
|-------------|---------|------------|-------|--|--|--|--|--|

a. Computed using alpha = .05

| Tests of Within-Subjects Contrasts |         |        |                         |    |             |
|------------------------------------|---------|--------|-------------------------|----|-------------|
| Source                             | Measure | factor | Type III Sum of Squares | df | Mean Square |
| factor                             | con     | Linear | .000                    | 1  | .000        |
|                                    | dec     | Linear | .260                    | 1  | .260        |
|                                    | mem     | Linear | .287                    | 1  | .287        |
|                                    | pre     | Linear | 24.503                  | 1  | 24.503      |
| factor * Readability               | con     | Linear | 4.378                   | 1  | 4.378       |
|                                    | dec     | Linear | .375                    | 1  | .375        |
|                                    | mem     | Linear | .110                    | 1  | .110        |
|                                    | pre     | Linear | 1.042                   | 1  | 1.042       |
| factor * Forumorder                | con     | Linear | 4.594                   | 1  | 4.594       |
|                                    | dec     | Linear | .000                    | 1  | .000        |
|                                    | mem     | Linear | .287                    | 1  | .287        |
|                                    | pre     | Linear | .753                    | 1  | .753        |
| factor * Readability * Forumorder  | con     | Linear | 5.753                   | 1  | 5.753       |
|                                    | dec     | Linear | .000                    | 1  | .000        |
|                                    | mem     | Linear | .344                    | 1  | .344        |
|                                    | pre     | Linear | 2.344                   | 1  | 2.344       |
| Error(factor)                      | con     | Linear | 56.901                  | 44 | 1.293       |
|                                    | dec     | Linear | 24.552                  | 44 | .558        |
|                                    | mem     | Linear | 10.003                  | 44 | .227        |
|                                    | pre     | Linear | 139.484                 | 44 | 3.170       |

| Tests of Within-Subjects Contrasts |         |        |       |       |                     |
|------------------------------------|---------|--------|-------|-------|---------------------|
| Source                             | Measure | factor | F     | Sig.  | Partial Eta Squared |
| factor                             | con     | Linear | .000  | 1.000 | .000                |
|                                    | dec     | Linear | .467  | .498  | .010                |
|                                    | mem     | Linear | 1.263 | .267  | .028                |
|                                    | pre     | Linear | 7.729 | .008  | .149                |
| factor * Readability               | con     | Linear | 3.385 | .073  | .071                |
|                                    | dec     | Linear | .672  | .417  | .015                |
|                                    | mem     | Linear | .484  | .490  | .011                |
|                                    | pre     | Linear | .329  | .569  | .007                |

|                                   |     |        |       |       |      |
|-----------------------------------|-----|--------|-------|-------|------|
| factor * Forumorder               | con | Linear | 3.552 | .066  | .075 |
|                                   | dec | Linear | .000  | 1.000 | .000 |
|                                   | mem | Linear | 1.263 | .267  | .028 |
|                                   | pre | Linear | .237  | .629  | .005 |
| factor * Readability * Forumorder | con | Linear | 4.448 | .041  | .092 |
|                                   | dec | Linear | .000  | 1.000 | .000 |
|                                   | mem | Linear | 1.515 | .225  | .033 |
|                                   | pre | Linear | .739  | .395  | .017 |
| Error(factor)                     | con | Linear |       |       |      |
|                                   | dec | Linear |       |       |      |
|                                   | mem | Linear |       |       |      |
|                                   | pre | Linear |       |       |      |

#### Tests of Within-Subjects Contrasts

| Source                            | Measure | factor | Noncent. Parameter | Observed Power <sup>a</sup> |
|-----------------------------------|---------|--------|--------------------|-----------------------------|
| factor                            | con     | Linear | .000               | .050                        |
|                                   | dec     | Linear | .467               | .103                        |
|                                   | mem     | Linear | 1.263              | .196                        |
|                                   | pre     | Linear | 7.729              | .776                        |
| factor * Readability              | con     | Linear | 3.385              | .436                        |
|                                   | dec     | Linear | .672               | .126                        |
|                                   | mem     | Linear | .484               | .105                        |
|                                   | pre     | Linear | .329               | .087                        |
| factor * Forumorder               | con     | Linear | 3.552              | .454                        |
|                                   | dec     | Linear | .000               | .050                        |
|                                   | mem     | Linear | 1.263              | .196                        |
|                                   | pre     | Linear | .237               | .076                        |
| factor * Readability * Forumorder | con     | Linear | 4.448              | .541                        |
|                                   | dec     | Linear | .000               | .050                        |
|                                   | mem     | Linear | 1.515              | .226                        |
|                                   | pre     | Linear | .739               | .134                        |
| Error(factor)                     | con     | Linear |                    |                             |
|                                   | dec     | Linear |                    |                             |
|                                   | mem     | Linear |                    |                             |
|                                   | pre     | Linear |                    |                             |

a. Computed using alpha = .05

#### Levene's Test of Equality of Error Variances<sup>a</sup>

|             | F     | df1 | df2 | Sig. |
|-------------|-------|-----|-----|------|
| ConsensusA  | 6.722 | 3   | 44  | .001 |
| ConsensusB  | 3.107 | 3   | 44  | .036 |
| DecisionA   | 6.360 | 3   | 44  | .001 |
| MembershipA | 6.479 | 3   | 44  | .001 |
| DecisionB   | 3.891 | 3   | 44  | .015 |
| MembershipB | 3.011 | 3   | 44  | .040 |
| PressureA   | .605  | 3   | 44  | .615 |
| PressureB   | 3.330 | 3   | 44  | .028 |

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.<sup>a</sup>

a. Design: Intercept + Readability + Forumorder + Readability \*

Forumorder

Within Subjects Design: factor

#### Tests of Between-Subjects Effects

Transformed Variable: Average

| Source                   | Measure | Type III Sum of Squares | df | Mean Square | F        |
|--------------------------|---------|-------------------------|----|-------------|----------|
| Intercept                | con     | 2975.940                | 1  | 2975.940    | 1245.269 |
|                          | dec     | 2661.773                | 1  | 2661.773    | 942.047  |
|                          | mem     | 2841.094                | 1  | 2841.094    | 664.449  |
|                          | pre     | 1989.260                | 1  | 1989.260    | 608.688  |
| Readability              | con     | 1.500                   | 1  | 1.500       | .628     |
|                          | dec     | 6.773                   | 1  | 6.773       | 2.397    |
|                          | mem     | 5.876                   | 1  | 5.876       | 1.374    |
|                          | pre     | 2.503                   | 1  | 2.503       | .766     |
| Forumorder               | con     | 9.065                   | 1  | 9.065       | 3.793    |
|                          | dec     | 20.628                  | 1  | 20.628      | 7.300    |
|                          | mem     | 1.969                   | 1  | 1.969       | .461     |
|                          | pre     | 1.500                   | 1  | 1.500       | .459     |
| Readability * Forumorder | con     | 2.344                   | 1  | 2.344       | .981     |
|                          | dec     | 29.815                  | 1  | 29.815      | 10.552   |
|                          | mem     | 1.829                   | 1  | 1.829       | .428     |
|                          | pre     | 9.065                   | 1  | 9.065       | 2.774    |
| Error                    | con     | 105.151                 | 44 | 2.390       |          |
|                          | dec     | 124.323                 | 44 | 2.826       |          |
|                          | mem     | 188.138                 | 44 | 4.276       |          |
|                          | pre     | 143.797                 | 44 | 3.268       |          |

### Tests of Between-Subjects Effects

Transformed Variable: Average

| Source                   | Measure | Sig. | Partial Eta Squared | Noncent. Parameter | Observed Power <sup>a</sup> |
|--------------------------|---------|------|---------------------|--------------------|-----------------------------|
| Intercept                | con     | .000 | .966                | 1245.269           | 1.000                       |
|                          | dec     | .000 | .955                | 942.047            | 1.000                       |
|                          | mem     | .000 | .938                | 664.449            | 1.000                       |
|                          | pre     | .000 | .933                | 608.688            | 1.000                       |
| Readability              | con     | .432 | .014                | .628               | .121                        |
|                          | dec     | .129 | .052                | 2.397              | .328                        |
|                          | mem     | .247 | .030                | 1.374              | .209                        |
|                          | pre     | .386 | .017                | .766               | .137                        |
| Forumorder               | con     | .058 | .079                | 3.793              | .478                        |
|                          | dec     | .010 | .142                | 7.300              | .753                        |
|                          | mem     | .501 | .010                | .461               | .102                        |
|                          | pre     | .502 | .010                | .459               | .102                        |
| Readability * Forumorder | con     | .327 | .022                | .981               | .163                        |
|                          | dec     | .002 | .193                | 10.552             | .888                        |
|                          | mem     | .517 | .010                | .428               | .098                        |
|                          | pre     | .103 | .059                | 2.774              | .371                        |
| Error                    | con     |      |                     |                    |                             |
|                          | dec     |      |                     |                    |                             |
|                          | mem     |      |                     |                    |                             |
|                          | pre     |      |                     |                    |                             |

a. Computed using alpha = .05

### Estimated Marginal Means

#### Readability \* Forumorder \* factor

|         |             |            |        | Mean  | Std. Error | 95% Confidence Interval |
|---------|-------------|------------|--------|-------|------------|-------------------------|
| Measure | Readability | Forumorder | factor |       |            | Lower Bound             |
| con     | High        | FTF-CMC    | 1      | 5.604 | .354       | 4.890                   |
|         |             |            | 2      | 6.083 | .426       | 5.225                   |

|     |      |         |   |       |      |       |
|-----|------|---------|---|-------|------|-------|
|     |      | CMC-FTF | 1 | 5.354 | .354 | 4.640 |
|     |      |         | 2 | 5.729 | .426 | 4.871 |
|     |      | FTF-CMC | 1 | 6.583 | .354 | 5.869 |
|     |      |         | 2 | 5.229 | .426 | 4.371 |
|     | Low  | CMC-FTF | 1 | 4.729 | .354 | 4.015 |
|     |      |         | 2 | 5.229 | .426 | 4.371 |
|     |      | FTF-CMC | 1 | 5.021 | .361 | 4.294 |
|     |      |         | 2 | 4.792 | .390 | 4.007 |
|     | High | CMC-FTF | 1 | 5.208 | .361 | 4.481 |
|     |      |         | 2 | 4.979 | .390 | 4.194 |
|     |      | FTF-CMC | 1 | 6.542 | .361 | 5.814 |
|     |      |         | 2 | 6.563 | .390 | 5.777 |
| dec | Low  | CMC-FTF | 1 | 4.500 | .361 | 3.773 |
|     |      |         | 2 | 4.521 | .390 | 3.736 |
|     |      | FTF-CMC | 1 | 6.063 | .447 | 5.162 |
|     |      |         | 2 | 5.875 | .419 | 5.031 |
|     | High | CMC-FTF | 1 | 5.271 | .447 | 4.370 |
|     |      |         | 2 | 5.542 | .419 | 4.697 |
|     |      | FTF-CMC | 1 | 5.104 | .447 | 4.204 |
|     |      |         | 2 | 5.292 | .419 | 4.447 |
|     | Low  | CMC-FTF | 1 | 5.104 | .447 | 4.204 |
|     |      |         | 2 | 5.271 | .419 | 4.426 |
|     |      | FTF-CMC | 1 | 4.542 | .472 | 3.591 |
|     |      |         | 2 | 3.875 | .561 | 2.745 |
| mem | Low  | CMC-FTF | 1 | 5.042 | .472 | 4.091 |
|     |      |         | 2 | 4.104 | .561 | 2.975 |
|     |      | FTF-CMC | 1 | 6.000 | .472 | 5.050 |
|     |      |         | 2 | 4.292 | .561 | 3.162 |
|     | High | CMC-FTF | 1 | 4.646 | .472 | 3.696 |
|     |      |         | 2 | 3.917 | .561 | 2.787 |
|     |      | FTF-CMC | 1 | 4.542 | .472 | 3.591 |
|     |      |         | 2 | 3.875 | .561 | 2.745 |
|     | pre  | CMC-FTF | 1 | 5.042 | .472 | 4.091 |
|     |      |         | 2 | 4.104 | .561 | 2.975 |
|     |      | FTF-CMC | 1 | 6.000 | .472 | 5.050 |
|     |      |         | 2 | 4.292 | .561 | 3.162 |

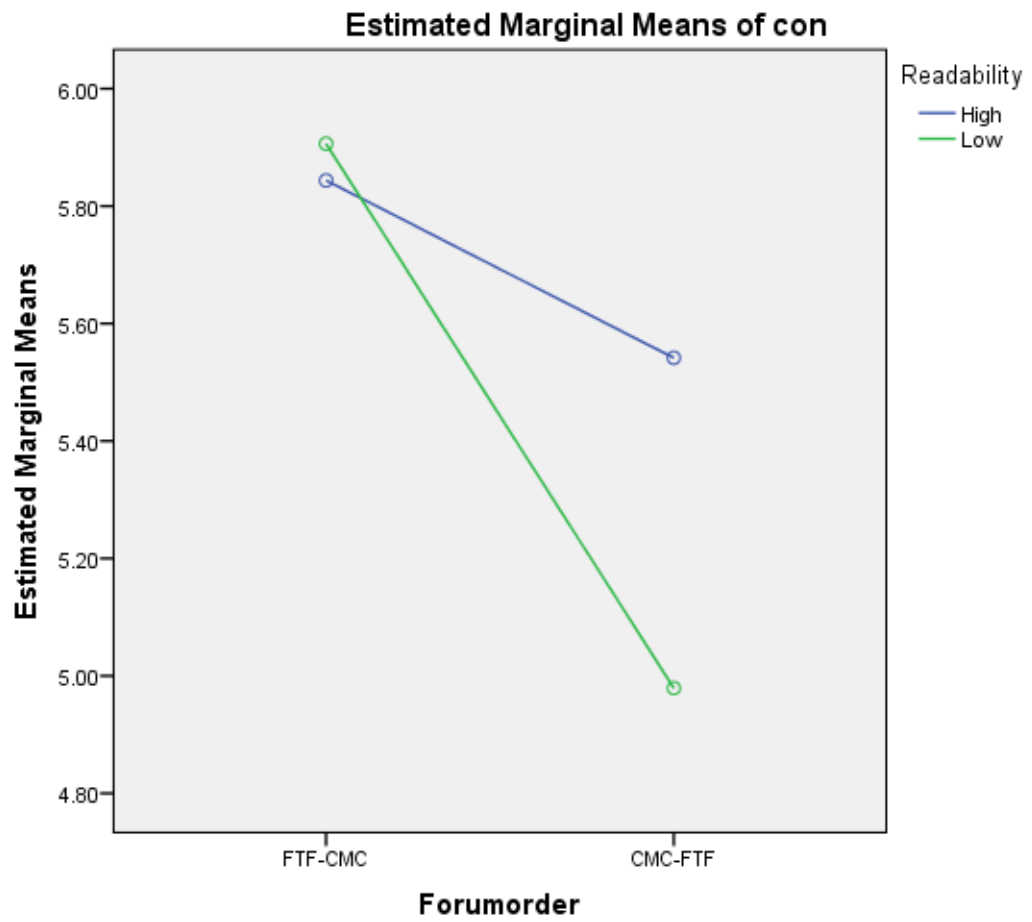
**Readability \* Forumorder \* factor**

|         |             |            |        | 95% Confidence Interval |
|---------|-------------|------------|--------|-------------------------|
| Measure | Readability | Forumorder | factor | Upper Bound             |
| con     | High        | FTF-CMC    | 1      | 6.319                   |
|         |             |            | 2      | 6.941                   |
|         |             | CMC-FTF    | 1      | 6.069                   |
|         |             |            | 2      | 6.587                   |
|         | Low         | FTF-CMC    | 1      | 7.298                   |
|         |             |            | 2      | 6.087                   |

|     |      |         |   |       |
|-----|------|---------|---|-------|
| dec | High | CMC-FTF | 1 | 5.444 |
|     |      |         | 2 | 6.087 |
|     |      | FTF-CMC | 1 | 5.748 |
|     |      |         | 2 | 5.577 |
|     |      | CMC-FTF | 1 | 5.936 |
|     |      |         | 2 | 5.764 |
|     | Low  | FTF-CMC | 1 | 7.269 |
|     |      |         | 2 | 7.348 |
|     |      | CMC-FTF | 1 | 5.227 |
|     |      |         | 2 | 5.306 |
|     | mem  | FTF-CMC | 1 | 6.963 |
|     |      |         | 2 | 6.719 |
|     |      | CMC-FTF | 1 | 6.171 |
|     |      |         | 2 | 6.386 |
|     |      | FTF-CMC | 1 | 6.005 |
|     |      |         | 2 | 6.136 |
| pre | High | CMC-FTF | 1 | 6.005 |
|     |      |         | 2 | 6.115 |
|     |      | FTF-CMC | 1 | 5.492 |
|     |      |         | 2 | 5.005 |
|     |      | CMC-FTF | 1 | 5.992 |
|     |      |         | 2 | 5.234 |
|     | Low  | FTF-CMC | 1 | 6.950 |
|     |      |         | 2 | 5.421 |
|     |      | CMC-FTF | 1 | 5.596 |
|     |      |         | 2 | 5.046 |

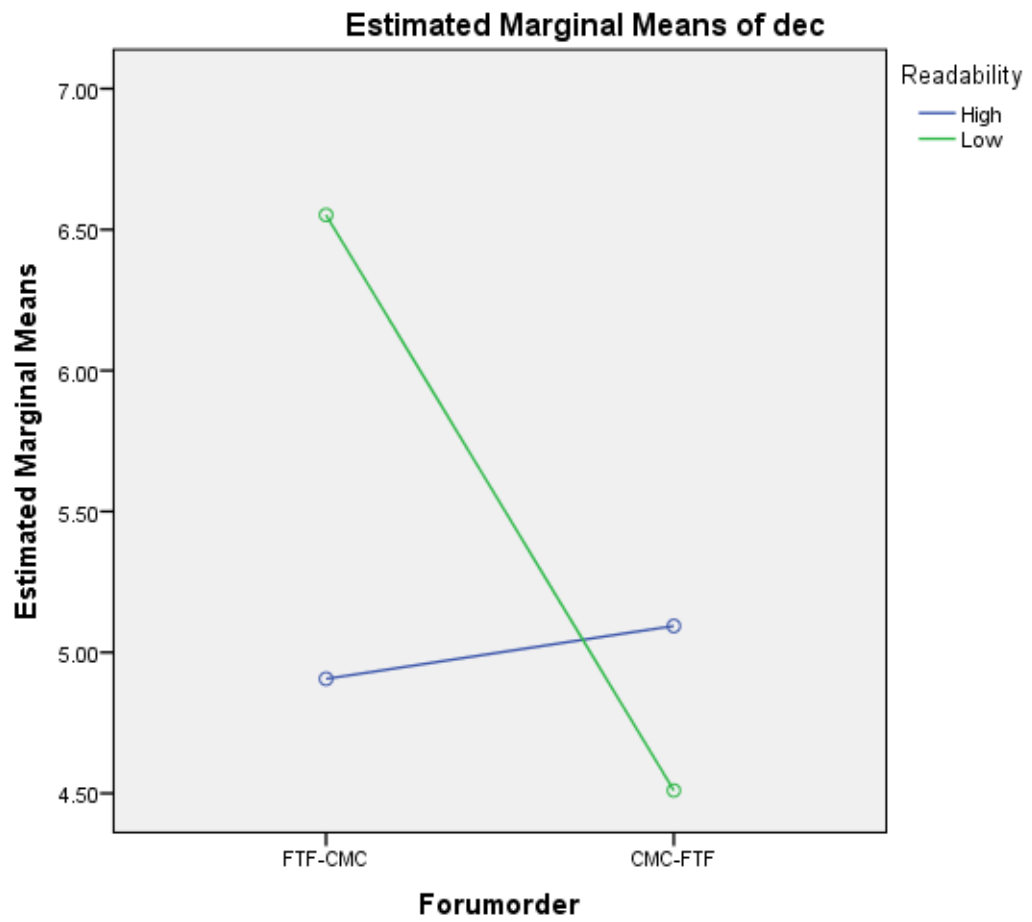
## Profile Plots

con

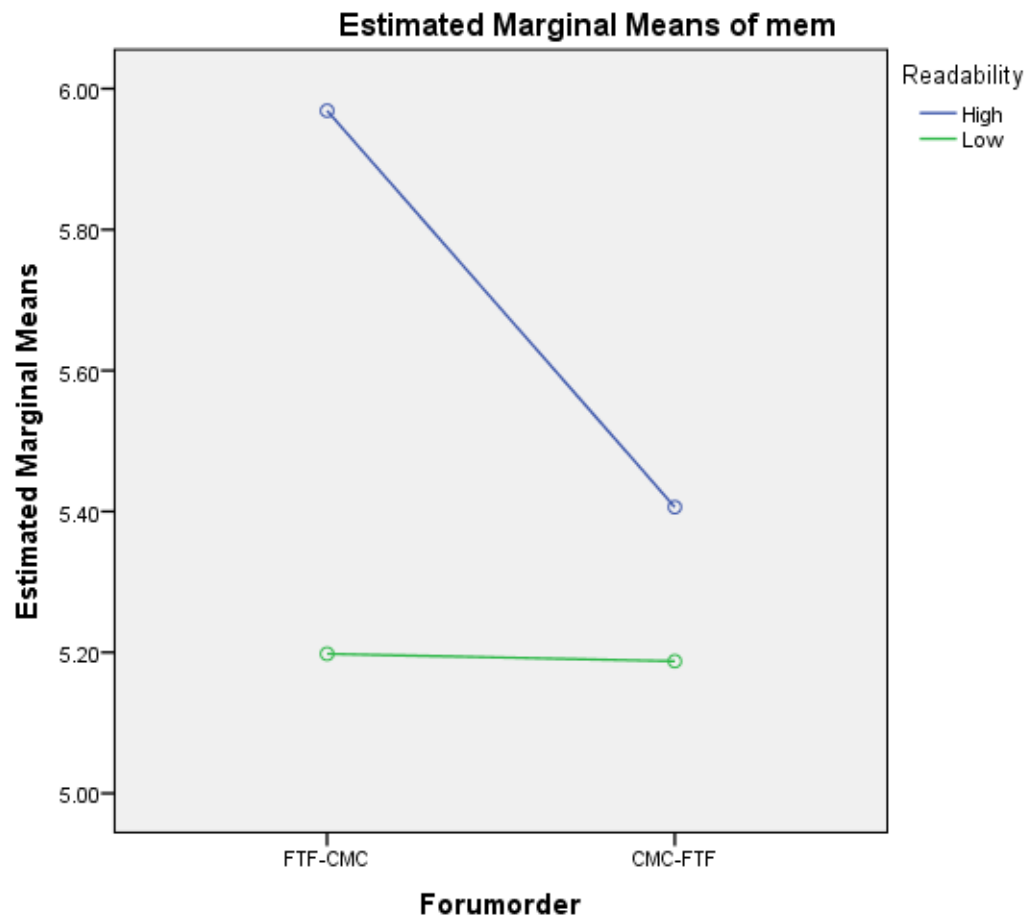


dec





mem



pre

